PB90-150947

Superfund Record of Decision (EPA Region 4): Smith's Farm Brooks, KY. (First Remedial Action), September 1989

(U.S.) Environmental Protection Agency, Washington, DC

29 Sep 89

U.S. Department of Commerce
National Technical Information Service
NTIS

50272-101

REPORT DOCUMENTATION PAGE

1. REPORT NO. EPA/ROD/R04-89/052

2.

3. Recipient's Accession No. PB90 150947/AS

4. Title and Subtitle
SUPERFUND RECORD OF DECISION
Smith's Farm, KY
First Remedial Action

5. Report Date 09/29/89

6.

7. Author(s)

8. Performing Organization Rept. No.

9. Performing Orgainization Name and Address

10. Project/Task/Work Unit No.

11. Contract(C) or Grant(G) No.
(C)
(G)

12. Sponsoring Organization Name and Address
U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460

13. Type of Report & Period Covered 800/000

14.

15. Supplementary Notes

16. Abstract (Limit: 200 words)

The Smith's Farm site is a 560-acre property in a rural area of Bullitt County, Kentucky. The site is bordered on the north, east, and west by forested hills and on the south by a residential area. Within the 560-acre property there is a 37.5-acre landfill that, until recently, was permitted by the State for the disposal of solid waste. The owner of this landfill was cited at various times by the State for permit violations. The property also includes an 80-acre area upgradient of the permitted landfill on a mile-long ridge between two intermittent creeks where the unpermitted disposal of drums containing hazardous waste occurred over a 20-year period. EPA investigations from 1979 to 1984 resulted in the removal of 6,000 surface drums containing hazardous waste including PCB-contaminated waste. This remedy addresses contaminated onsite soil, sediment, and drums within the 80-acre area. A second operable unit will address the remaining potential threats associated with the landfill, deep ground water aquifers, and other suspected areas of drum disposal. The primary contaminants of concern affecting the soil and sediment are organics including PCBs and PAHs, and metals including lead.

The selected remedial action for this site includes excavation and onsite incineration of approximately 26,200 cubic yards of contaminated soil, surface drums, buried drums, and fill material from Area B (as defined in the RI/FS), and (Continued on next page)

17. Document Analysis a. Descriptors
Record of Decision - Smith's Farm, KY
Final Remedial Action - Final
Contaminated Media: soil, sediment
Key Contaminants: organics (PCBs, PAHs), metals (lead)

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

18. Availability Statement

19. Security Class (This Report) None

20. Security Class (This Page) None

21. No. of Pages 99

22. Price A05

(See ANSI-Z39.18)

See Instructions on Reverse

OPTIONAL FORM 272 (4-77)
(Formerly NTIS-35)
Department of Commerce

PB90-150947

United States
Environmental Protection
Agency

Office of
Emergency and
Remedial Response

EPA/ROD/R04-89/052
September 1989

EPA

Superfund Record of Decision:

Smith's Farm, KY

REPRODUCED BY
U.S. DEPARTMENT OF COMMERCE
NATIONAL TECHNICAL INFORMATION SERVICE
SPRINGFIELD, VA. 22161

EPA/ROD/R04-89/052
Smith's Farm, KY
First Remedial Action - Final

16. Abstract (Continued)

approximately 5,200 cubic yards of contaminated onsite sediment from the valley streams; solidification/fixation of approximately 50 percent of the treated material followed by placement of all treated or solidified material in Area B; incineration of a small volume of hot spot material in Area A and consolidation of waste and construction of a RCRA cap over Area A; construction of a leachate-collection system to collect leachate from Area A; access restrictions (fencing) around contaminated areas; ground water monitoring for up to 27 years; maintenance of the RCRA cap and the leachate collection system; and leachate removal and disposal for up to 30 years. The estimated present worth cost for this remedy is $26,900,000, which includes O&M costs of $1,330,000.

RECORD OF DECISION
REMEDIAL ALTERNATIVE SELECTION

SMITH'S FARM SITE- FIRST OPERABLE UNIT
BROOKS, KENTUCKY

PREPARED BY:
U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION IV
ATLANTA, GEORGIA

RECORD OF DECISION

Remedial Alternative Selection

SITE NAME AND LOCATION

Smith's Farm Site (First Operable Unit)
Brooks, Kentucky

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for the Smith's Farm site (First Operable Unit), Brooks, Kentucky, developed in accordance with CERCLA, as amended by SARA, and to the extent practicable, the National Contingency Plan. The following documents form the basis for selection of the remedial action:

- Remedial Investigation Report, Smith's Farm Site
- Feasibility Study Report, Smith's Farm Site
- Summary of Remedial Alternative Selection
- Responsivenesss Summary
- Staff Recommendations and Reviews

DESCRIPTION OF THE REMEDY

The function of this remedy is to reduce the risks associated with exposure to contaminated, on-site surface soils, to contaminated, on-site stream sediments, and to contaminated, on-site surface and ground waters.

The major components of the selected remedy include:

Site Area B and Stream Sediments

- Excavation to bedrock of contaminated soil and waste materials from site Area B and excavation of contaminated stream sediments
- Incineration of the contaminated materials from Area B and the contaminated stream sediments
- Solidification/fixation of the treatment residuals

Site Area A

- Recontouring Area A to achieve a maximum 18 percent slope, combined with the consolidation of wastes from peripheral areas and retaining wall construction for slope stabilization
- "RCRA" Cap over Area A with the incineration of a small percentage of contaminated Area A soil and/or waste, as necessary and cost effective
- Construction of a leachate-collection system to collect contaminated water discharging from Area A

General

- Access restriction (fencing) around contaminated areas
- Annual ground-water monitoring for up to twenty seven years
- Maintenance of the RCRA cap and the leachate collection system for up to thirty years
- Leachate removal and disposal for up to thirty years

DECLARATION

The selected remedy is protective of human health and the environment, attains Federal and State requirements that are applicable or relevant and appropriate to the remedial action, and is cost-effective. This remedy satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element and utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable. However, because of the balancing of cost factors with the protection of human health and the environment, hazardous substances may remain in the soil in excess of health-based cleanup levels.

Because this remedy may result in hazardous substances remaining on site above health-based levels, a review will be conducted within five years after the commencement of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

9/29/89
Date

Greer C. Tidwell
Greer C. Tidwell
Regional Administrator

SUMMARY OF REMEDIAL ALTERNATIVE SELECTION

SMITH'S FARM SITE- FIRST OPERABLE UNIT
BROOKS, KENTUCKY

PREPARED BY:
U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION IV
ATLANTA, GEORGIA

TABLE OF CONTENTS

1.0 INTRODUCTION ---- 1
1.1 Site Location and Description ---- 1
1.2 Site History ---- 3
2.0 ENFORCEMENT ANALYSIS ---- 4
3.0 HIGHLIGHTS OF COMMUNITY PARTICIPATION ---- 7
4.0 SCOPE AND ROLE OF OPERABLE UNIT ---- 7
5.0 CURRENT SITE STATUS ---- 8
5.1 Environmental Setting ---- 8
5.1.1 Bedrock/Geology ---- 8
5.1.2 Soils ---- 9
5.1.3 Hydrogeology ---- 9
5.1.4 Surface Water and Topography ---- 10
5.2 Study Area Contamination ---- 10
5.2.1 Surface Soil Contamination ---- 10
5.2.2 Subsurface Soil Contamination ---- 12
5.2.2.1 Area C ---- 12
5.2.2.2 Area B ---- 12
5.2.2.3 Area A ---- 16
5.2.2.4 Other areas ---- 16
5.2.2.5 Summary of subsurface soil contamination ---- 17
5.2.3 Ground-Water Contamination ---- 17
5.2.3.1 Sampling results and data analysis ---- 17
5.2.3.2 Summary of ground-water data ---- 21
5.2.4 Surface Water Contamination ---- 25
5.2.4.1 Organic contamination ---- 25
5.2.4.2 Inorganic contamination ---- 27
5.2.4.3 Surface water contamination summary ---- 27
5.2.5 Stream Sediment Contamination ---- 27
5.2.5.1 Organic contamination ---- 27
5.2.5.2 Inorganic contamination ---- 31
5.2.6 Summary of the Study Area Contamination ---- 31
6.0 SUMMARY OF SITE RISKS ---- 38
6.1 Introduction ---- 38
6.2 Assumptions and Methods of Analysis ---- 40
6.2.1 Exposure ---- 40
6.2.2 Chemicals ---- 42
6.2.3 Risks ---- 42
6.3 Contaminants Considered in the Risk Analysis ---- 44
6.3.1 Surface Soils ---- 44
6.3.2 Subsurface Soils ---- 44
6.3.3 Surface Water ---- 45
6.3.4 Stream Sediments ---- 45
6.3.5 Ground Water ---- 46
6.4 Toxicity Assessment Information ---- 46
6.5 Risk Characterization ---- 48
6.5.1 Current-Use Scenario Risks ---- 48
6.5.1.1 Risks to Trespassers from Surface Soils ---- 48
6.5.1.2 Risks to Trespassers from Sediments ---- 49
6.5.1.3 Risks to Trespassers from Contact with Surface Water ---- 49

Table of Contents, continued

6.5.1.4 Risks to Off-Site Residents from Contact with Surface Water and Stream Sediments -----49
6.5.1.5 Risks from Inhalation of Dust Generated by Dirt Bikes -----49
6.5.1.6 Risks to Trespassers from Inhalation of Volatile Organics Released from Surface Water -----49
6.5.1.7 Risks from the Use of Residential Wells -----51
6.5.2 Future-Use Scenario Risks -----51
6.5.2.1 Risks from Direct Contact with Soils by On-Site Residents -----51
6.5.2.2 Risks from Use of On-Site Ground Water -----51
6.5.2.3 Risks to Off-Site Residents -----53
6.5.2.4 Other Future-Use Risks -----53
6.5.3 Qualitative Risks -----53
6.5.4 Summary of Human Health Risks -----53
6.6 Environmental Risks -----53
6.6.1 Receptors -----54
6.6.2 Exposure Rates -----54
6.6.3 Toxicity Assessment -----54
6.6.4 Risk Assessment Results -----55
7.0 DESCRIPTION OF REMEDIAL ACTION ALTERNATIVES -----56
7.1 The "No Action" Alternative -----56
7.2 The RCRA Cap Alternative -----58
7.3 Incineration, Solidification/Fixation, and On-Site Disposal -----59
7.4 Capping of Area A, Incineration and Solidification/Fixation of Area B -----61
7.5 Off-Site Incineration and Off-Site Disposal -----62
7.6 Comparison of the Alternatives -----63
7.6.1 Overall Protection of Human Health and the Environment -----65
7.6.2 Compliance with ARARs -----65
7.6.3 Long-Term Effectiveness and Permanence -----65
7.6.4 Reduction of Toxicity, Mobility, or Volume Through Treatment -----65
7.6.5 Short-Term Effectiveness -----66
7.6.6 Implementability -----66
7.6.7 Cost -----66
7.6.8 State Acceptance -----66
7.6.9 Community Acceptance -----66
8.0 THE SELECTED REMEDY -----67
8.1 Remediation Goals -----67
8.2 Attainment of Applicable or Relevant and Appropriate Requirements of Environmental Laws -----70
8.2.1 Soil, Sediment, and Source Materials ARARs -----70
8.2.2 Ground Water/Surface Water ARARs -----72
8.3 Cost-Effectiveness -----74
8.4 Utilization of Permanent Solutions and Alternative Treatment Technologies (or Resource Recovery Technologies) to the Maximum Extent Practicable -----74
8.5 Preference for Treatment as a Principal Element -----76

Table of Contents, continued

LIST OF FIGURES

Figure Page

1 Site Location Map -- 2
2 Surface Soil Sample Locations ---------------------------- 10
3 Subsurface Soil Sample Locations ------------------------- 14
4 Monitoring Well Locations -------------------------------- 20
5 Surface Water Sample Locations --------------------------- 26

LIST OF TABLES

Table Page

1 Summary of Organic Compounds Detected in Study Area Surface Soils -- 12
2 Summary of Metals Detected in Study Area Surface Soils ----- 13
3 Summary of Organic Compounds Detected in Study Area Subsurface Soils --- 17
4 Summary of Metals Detected in Study Area Subsurface Soils -- 19
5 Summary of Shallow Ground Water Contamination by Organic Compounds, Study Area Monitoring Wells- June 1988 ---------- 22
6 Summary of Shallow Ground Water Contamination by Organic Compounds, Study Area Monitoring Wells- December 1988 ------ 23
7 Summary of Shallow Ground-Water Contamination by Inorganic Contaminants, Study Area Monitoring Wells ----------------- 24
8 Summary of Study Area Surface Water Contamination by Organic Compounds -- 28
9 Summary of Study Area Surface-Water Contamination by Inorganic Substances --- 30
10 Summary of Stream Sediment Contamination by Organic Compounds 32
11 Comparison of Study Area to Downstream Sediment Contamination by Organic Compounds ------------------------------------ 34
12 Summary of Stream Sediment Contamination by Inorganic Substances --- 36
13 Comparison of Study Area to Downstream Sediment Contamination by Inorganic Substances ---------------------------------- 37
14 Substances Exceeding Water Quality Criteria Levels --------- 39
15 Summary of Health Effects Criteria for Chemicals of Potential Concern -- 47
16 Total Carcinogenic and Noncarcinogenic Risks for all Exposure and Environmental Media Conditions - Current-Use Scenario -- 50
17 Total Carcinogenic and Noncarcinogenic Risks for all Exposure and Environmental Media Conditions - Future-Use Scenario --- 52
18a Comparison of Aquatic Toxicity Criteria to Concentrations of Chemicals Found in Streams at Smith's Farm --------------- 57
18b Comparison of Assumed Sediment Quality Criteria to Concentrations of Chemicals Found in Streams at Smith's Farm 57
19 Comparison of the Five Remedial Alternatives --------------- 64
20 Action Levels for Soil and Sediments ---------------------- 68

APPENDIX - RESPONSIVENESS SUMMARY

RECORD OF DECISION
SUMMARY OF REMEDIAL ALTERNATIVE SELECTION
SMITH'S FARM SITE- FIRST OPERABLE UNIT
BROOKS, KENTUCKY

1.0 INTRODUCTION

The Smith's Farm site was included on the National Priorities List (NPL) in June 1986. An approximate 80-acre area of unpermitted drum disposal at the site has been the subject of a Remedial Investigation (RI) and Feasibility Study (FS). The RI/FS activities commenced in July 1987 and were performed by the U.S. EPA Region IV (EPA) under the direction of the EPA Remedial Project Manager (RPM). The RI Report, which examines the quality of air, soil, surface water, stream sediments, and shallow aquifer ground water at the site was completed in January 1989. The draft FS Report, which develops and examines alternatives for site remediation, was submitted to the public information repository with the RI Report in March, 1989.

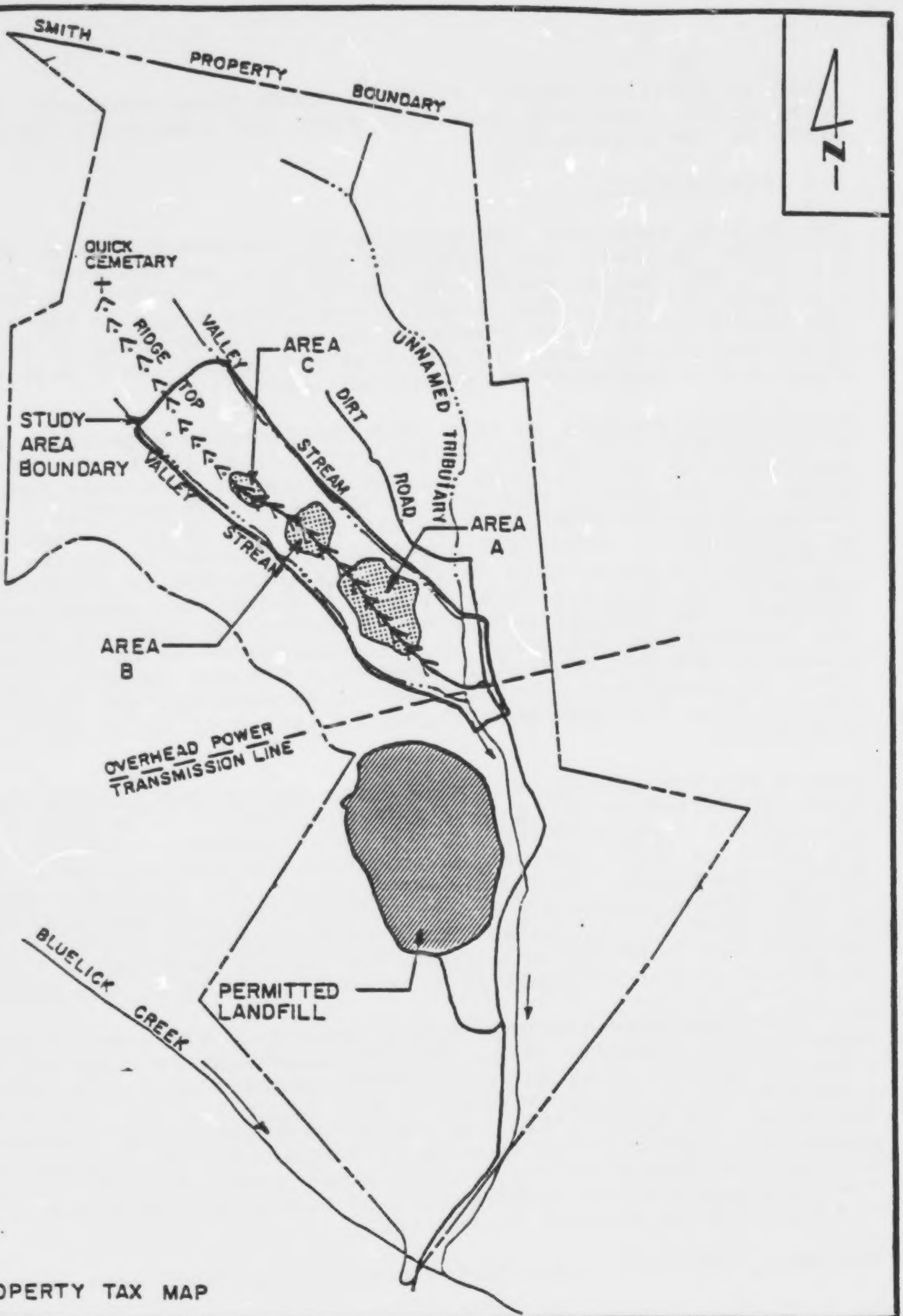
This Record of Decision has been prepared to summarize the remedial alternative selection process and to present the selected remedial alternative, in accordance with Section 113(k)(2)(B)(v) and Section 117(b) of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA) as amended by the Superfund Amendments and Reauthorization Act (SARA) (P.L. 99-499). The Administrative Record for the Smith's Farm site forms the basis for the Record of Decision contained herein.

1.1 Site Location and Description

The Smith's Farm site is a 560-acre property located in a rural area of Bullitt County, Kentucky approximately 1.5 miles southwest of Brooks, Kentucky. The site is located at an approximate latitude 38° 02' 45" and longitude 85° 44' 00" (Figure 1).

The site is bordered on the north, east, and west by forested hills and on the south by a residential area along Pryor Valley Road. Within the Smith's Farm property, there is a 37.5-acre landfill that, until recently, was permitted by the Commonwealth of Kentucky for the disposal of solid waste. The site also includes an approximate 80-acre area (Study Area) where the unpermitted disposal of drums containing hazardous waste has occurred over a 20-year period. This 80-acre area is the focus of the first operable unit RI/FS for which this Record of Decision is written. The 37.5-acre landfill will be the subject of a second operable unit RI/FS.

The Study Area is on a mile-long ridge between two intermittent creeks. These two creeks drain into an unnamed tributary which flows


N
SMITH PROPERTY BOUNDARY
QUICK CEMETARY
RIDGE TOP
VALLEY
VALLEY STREAM
AREA C
DIRT ROAD
UNNAMED TRIBUTARY
STUDY AREA BOUNDARY
STREAM
AREA A
STREAM
AREA B
OVERHEAD POWER TRANSMISSION LINE
BLUELICK CREEK
PERMITTED LANDFILL

SOURCE: PROPERTY TAX MAP

SCALE
0' 660'

Source: RI Report

SMITH'S FARM
SITE MAP

FIGURE
1

south to Bluelick Creek. Bluelick Creek flows southeast into Floyd's Fork, which flows into Salt Lick River and eventually into the Ohio River to the northeast.

1.2 Site History

The Smith's Farm site was owned by Mr. Leonard O. Smith, Sr. until his death in 1969. The permitted landfill was operated by Smith and his son, Mr. Harlan Smith, who continued the landfill operation until his death in 1978. The landfill operations began in the late 1950's; the landfill was first permitted by the Commonwealth of Kentucky in 1973. The current owner of the landfill is Mrs. Mary Ruth Smith, whose nephew operated the permitted landfill.

According to records on file with the Kentucky Department for Environmental Protection, a 1969 site inspection by the Kentucky Department of Health noted a large volume of uncovered industrial waste was present in the area of the permitted landfill. A 1972 inspection noted that the landfill site was in poor condition with a large volume of industrial waste being disposed of at the landfill. Following its permitting in 1973, the Commonwealth of Kentucky approved the disposal of a variety of industrial wastes into Smith's landfill. On several occasions following the landfill permitting, the landfill was inspected by representatives of the Kentucky Natural Resources and Environmental Protection Cabinet (NREPC). At various times following the initial landfill permitting, the landfill owner was cited by the Commonwealth for violation of solid waste disposal regulations.

Over a 20-year period, numerous drums containing various amounts and types of hazardous substances were disposed of in several areas on the Smith's Farm property north of the permitted landfill. In 1979 and again in 1981, EPA conducted limited investigations of the Smith's Farm site, including some unpermitted disposal areas. These initial investigations did not uncover a serious environmental hazard at this site, and an initial 1982 hazard ranking score for the Smith's Farm site was well below the cutoff level of 28.5 for inclusion on the National Priorities List (NPL) of Superfund sites.

The NREPC surveyed the unpermitted drum disposal area of the Smith's Farm site in February 1983, and the investigators suspected that a substantial number of drums had been disposed of at the site. The Commonwealth of Kentucky subsequently requested that EPA investigate the site. In April 1983, the NUS Corporation, under contract to EPA, conducted a magnetometer survey of suspected drum disposal areas on the Smith's Farm property. This survey gave the first indication of the location and the areal extent of probable drum disposal areas in the unpermitted portion of the site.

Following the 1983 magnetometer survey, the Study Area was visited in

April 1984 by representatives of EPA's Emergency Response and Control Section and EPA's Environmental Response Team, EPA's Technical Assistance Team, and the Kentucky Department for Environmental Protection. Samples of waste from several drums were collected in an effort to determine if the site warranted consideration for Superfund cleanup. The investigation revealed that the potential for the release of hazardous chemicals from the drums represented an imminent and substantial endangerment to public health and the environment Therefore, the site qualified for immediate removal funds, considering the regulations in the National Oil and Hazardous Substances Pollution Contingency Plan (40 CFR Part 300 Section 300.65).

In June 1984, the immediate removal of surface drums containing hazardous wastes began. This emergency response action continued until mid-August 1984. The following quantities of waste were removed in this action:

- 6,000 drums were removed from the surface
- 2,000 of these drums contained hazardous waste
- 200 drums contained PCB contaminated wastes
- 15,000 gallons of flammable liquids were removed

In October 1984, the Smith's Farm site was proposed once again for listing on the NPL. Both the ground water and surface water pathways received a higher score than the previous ranking in 1982 because of the identification of targets (ground and surface-water users potentially affected by site releases) in the 1984 ranking. In June 1986, the Smith's Farm site was included on the NPL.

Between June 1986 and July 1987, EPA conducted various activities related to the notification and investigation of Smith's Farm potentially responsible parties (PRPs). In July, 1987, the RI/FS activities for the Smith's Farm site began.

Both the RI and FS Reports were submitted in draft form to the public information repository in March 1989. As required under Section 117 (a) of CERCLA, as amended by SARA, the Proposed Plan for the Smith's Farm site was prepared and sent to interested parties in late March 1989. Following its distribution, a public meeting to present and discuss EPA's preferred remedial alternative for Operable Unit 01 was held on April 11, 1989. A review period for public comment on the preferred alternative extended from April 11 to May 2, 1989.

2.0 ENFORCEMENT ANALYSIS

Potentially Responsible Parties (PRPs) were notified of EPA's immediate removal action at the Smith's Farm site in June 1984. In March 1987, PRPs were notified of EPA's intent to initiate RI/FS activities at the Smith's Farm site. In both cases, the identified PRPs declined to participate in activities at the site. The 1984 removal action and the subsequent RI/FS have, therefore, been EPA-lead proceedings. On October 20, 1987, prior to initiating the RI field work, EPA held a meeting in Atlanta to discuss the site status with the PRPs.

On March 15, 1989, at the request of PRPs, EPA held a meeting with PRPs to discuss possible PRP involvement in the current and future site activities regarding both the first operable unit RI/FS and a planned second operable unit RI/FS at Smith's Farm. The second operable unit RI/FS is planned for this site to address deep ground water, the permitted landfill, and additional areas of suspected drum disposal identified in the first RI/FS. Notice letters concerning this second RI/FS have been sent to the Smith's Farm PRPs, inviting their participation in this RI/FS.

Upon completion of the first operable unit RI/FS of the Smith's Farm site, EPA will begin the implementation of the Remedial Design (RD) and the Remedial Action (RA) phases of the first operable unit. After selection of the first operable unit RI/FS remedy, RD/RA notice letters will be sent to PRPs identified for the Smith's Farm site. EPA may issue a CERCLA Section 106 Order to the PRPs to perform the RD/RA.

If the identified PRPs decline to participate in either the second operable unit RI/FS or the RD/RA for the first operable unit, EPA will perform the RI/FS and RD/RA and seek to recover costs at a later date. In June 1989, EPA sent demand letters to PRPs to recover response costs from the removal action in 1984.

3.0 HIGHLIGHTS OF COMMUNITY PARTICIPATION

The RI/FS Reports were released to the public in March 1989 and the Proposed Plan announcing EPA's preferred alternative (Alternative #4) for site remediation was released to the public on April 3, 1989. These two documents were made available to the public through the public information repository that has been established at the Ridgeway Memorial Library, Shepherdsville, Kentucky, and at EPA Region IV. The notice of availability of these documents was published in the Proposed Plan Fact Sheet and in the Louisville Courier-Journal on April 6, 1989. Prior to release of the RI/FS Reports, an active effort was made on behalf of EPA to inform interested parties of EPA's activities at the site, which included a March 2, 1988 public meeting at which EPA announced plans for conducting the Remedial Investigation. A February 28 publication in the Louisville Courier-Journal and release of fact sheets notified the public of this meeting.

A public comment period on EPA's preferred remedial alternative was held from April 11 through May 2, 1989. Additionally, a public meeting was held on April 11, 1989. At this meeting, representatives from EPA Region IV answered questions about problems at the site, remedial alternatives considered, and the preferred remedial alternative. A response to the comments received during this period is included in the Responsiveness Summary, which is a part of this Record of Decision. This decision document presents the selected remedial action for the Smith's Farm Site -- Operable Unit 01, in Brooks, Kentucky, chosen in accordance with CERCLA, as amended by SARA and, to the extent practicable, the National Contingency Plan. The decision for this site is based on the administrative record, which has also been established in the public information repository (Ridgeway Memorial Library) and in the EPA Region IV office.

4.0 SCOPE AND ROLE OF OPERABLE UNIT

Under certain circumstances, mitigation of the threat(s) posed by a Superfund site can be more effectively dealt with in stages, or operable units. The Smith's Farm site is approximately 560 acres, which includes an approximate 80-acre area of unpermitted drum disposal, a 37.5-acre permitted solid waste disposal landfill, and, as determined in the RI/FS, additional areas of suspected drum disposal. In the Summer of 1987, EPA Region IV and the Commonwealth of Kentucky defined an area (the 80-acre unpermitted drum disposal Study Area) that deserved immediate attention in the form of an RI/FS. This area appeared to be the most serious threat at the site based on the voluminous drums in this area and suspected waste types present. Other areas of the 560-acre property would be evaluated at a later date if the RI/FS established a need for a subsequent investigation.

During the Spring of 1988 (during the RI field sampling program), EPA elected to defer evaluation of the deep aquifers beneath the site due to the complexities of, and time associated with, implementation of such a program at this site, and the premise that site contaminants were being transported primarily by surface water runoff and through the surficial aquifer. (Sampling of private drinking water supplies in the vicinity of the Smith's Farm site has been performed on a quarterly basis since the Spring of 1988 and no degradation of water quality in these supplies as a result of the Smith's Farm site has been detected). Additionally, in the Spring of 1989, the Commonwealth of Kentucky informed EPA Region IV of its decision not to renew the Smith's Landfill solid waste disposal permit and requested EPA to conduct an RI/FS of the landfill area.

Operable Unit 01, authorized by this Record of Decision, addresses the contaminated soils, sediments, surficial aquifer, and drums of the 80-acre unpermitted drum disposal area. Operable Unit 02 (anticipated initiation of Operable Unit 02 is by December 1989) will address the remaining potential threats associated with the Smith's Farm site which include the afore-mentioned Smith's permitted landfill, deep ground water aquifers, and other suspected areas of drum disposal. During design of the selected remedy, information obtained through Operable Unit 02 (e.g., deep ground water aquifer data) will be evaluated against the components of Alternative 4 to insure that Alternative 4 remains consistent, in light of the additional information, with the anticipated absence of a deep aquifer ground water exposure pathway. Until such information is obtained, however, quarterly monitoring of private drinking water supplies will be performed by EPA to insure the integrity of the resident's water supply. It is anticipated that Operable Unit 02 will be the final response action for the Smith's Farm site.

5.0 CURRENT SITE STATUS

5.1 Environmental Setting

5.1.1 Bedrock/Geology

Underlying the Smith's Farm site is the Mississippian-age Borden Formation, which in descending order includes the Holtzclaw Siltstone Member, the Nancy Member (silty shale), the Kenwood Siltstone Member and the New Providence Shale Member. The depth to bedrock onsite is commonly four to six feet, and rock outcrops at Smith's Farm have been observed. Underlying the Borden Formation is the Devonian-age New Albany shale, which overlies the Silurian-age Louisville Limestone. The Silurian and Devonian-age rocks crop out approximately one mile east of the Smith's Farm site.

The rocks underlying the site are nearly horizontal; the regional dip of the top of the New Albany shale is to the west at about 110 feet per mile. No faults have been mapped by the U.S. Geological Survey in this part of Kentucky. Some joints and possibly small-scale faults are expected to be present in the rocks underlying the site.

5.1.2 Soils

Soils of the area are loamy on the slopes and ridges, and gravelly loam in the small tributary floodplains of the site. Soils are either the product of weathering of the underlying bedrock, or are derived from material washed downslope from nearby source areas.

5.1.3 Hydrogeology

The shallow hydrogeology of the Smith's Farm site was defined to some extent by the RI fieldwork, and from references cited in the RI report. Ground water is found in the residual soil, which constitutes a very poor, unconfined aquifer. Yields to wells would generally not be sufficient for domestic use. Ground-water flow in this aquifer is controlled by topography and the nature of the underlying bedrock surface.

Beneath the saturated part of the soil profile, ground water occurs primarily in joints or bedding planes in the shale. Yields in the shaley rock would not be expected to be great anywhere, although zones of bedrock jointing yield appreciably more water to wells than the less fractured rock. The RI report notes that most of the residential wells in the vicinity of the Smith's Farm site are completed into the shallow (shaley) bedrock. The degree of hydraulic connection between the saturated zone in the soil and in the underlying shale has not been established in the RI. According to local residents, ground water derived from the shaley aquifer is saline and contains excessive iron and sulfur.

Underlying the shale is a confined limestone aquifer. This aquifer is generally more productive than the overlying shale, especially in favorable topographic or hydrogeologic settings. The water quality in this aquifer is also poor. One resident has been identified near the Smith's Farm site who obtains water from the limestone aquifer.

The nature of ground-water flow in the bedrock aquifers was not investigated during the first operable unit RI/FS; therefore, no information is yet available concerning any potential ground-water contamination in these aquifers caused by waste disposal on the Smith's Farm property.

5.1.4 Surface Water and Topography

The Study Area of the first operable unit RI/FS is defined by a narrow, steeply-sloping ridge bounded by two first-order streams. The maximum relief in the Study Area exceeds 150 feet. The slope on the steeper northeast side of the ridge is approximately 50% in some areas. Observations made during the RI fieldwork indicate that the two streams bounding the site dry up during periods of minimal precipitation. Baseflow runoff in these streams is low during even short dry periods because of the limited recharge area, thin saturated soil zone, and the low permeability of the shale.

5.2 Study Area Contamination

5.2.1 Surface Soil Contamination

As part of the RI, samples were taken at several locations in the Study Area (Figure 2) in order to define the nature and extent of surface soil contamination. Surface soil sample locations were in areas of apparent contamination and/or areas of potential human exposure to contaminants. Additional samples were taken outside areas of known or suspected waste disposal at the Smith's Farm site to establish background conditions.

The surface soil sampling protocol is documented in the RI report. Surface soil samples were tested to determine their concentrations of volatile and extractable organics and inorganic parameters (EPA's "full scan" list).

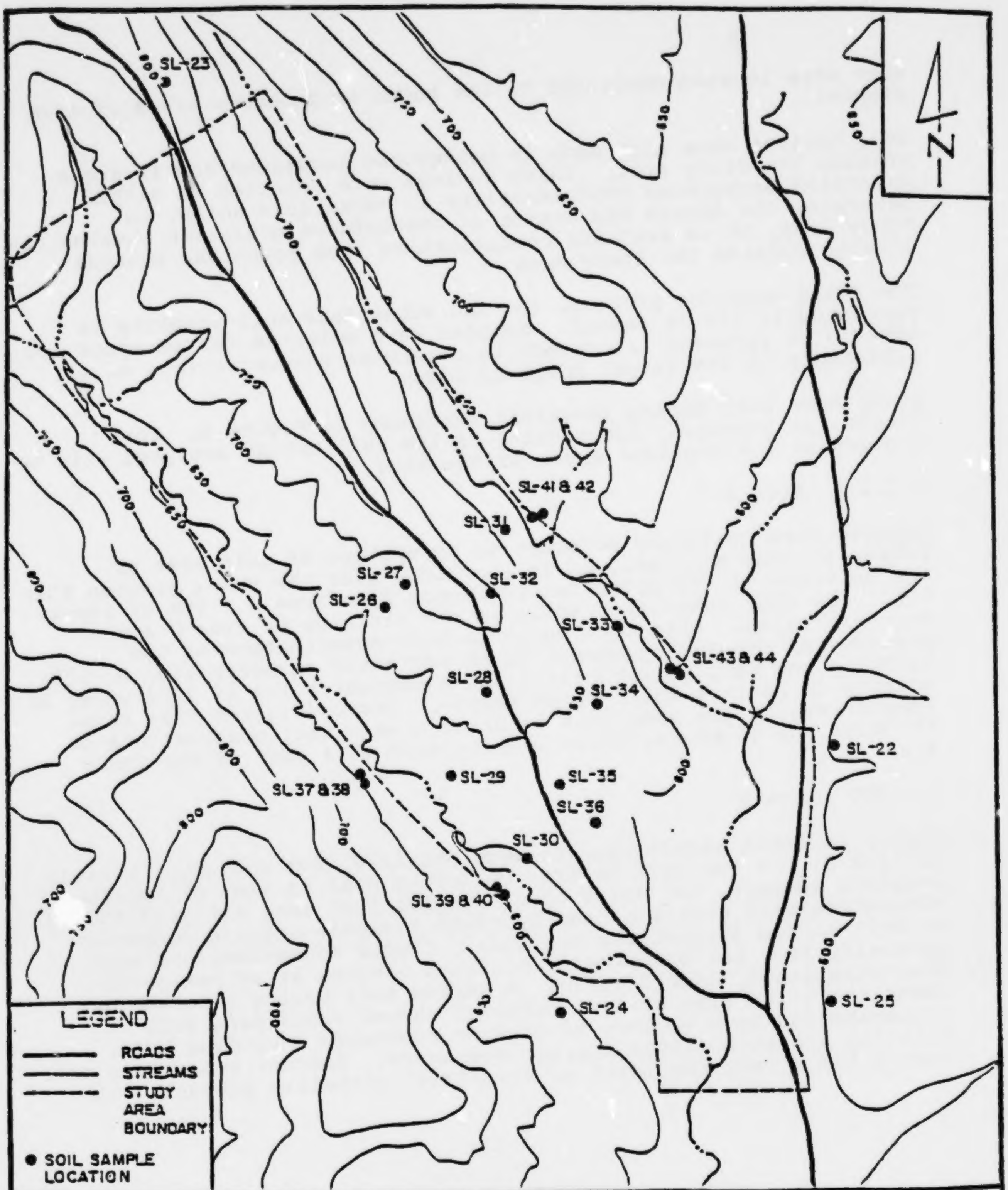
Of the 10 samples collected from suspected contaminated areas, all but one showed contamination from organic compounds. Most of these samples contained concentrations of PCBs ranging from 1 mg/kg to 200 mg/kg. Surface soils in the Study Area also appear to generally be contaminated by one or more extractable organic compounds, primarily phthalates. Volatile organic contamination of surface soils appears to be minor, or is less areally extensive than contamination by several other organic compounds. A summary of the organic compounds detected in surface soils is presented in Table 1.

The background surface soil samples were uncontaminated, except that low levels of toluene were found in each sample. The toluene concentrations in these and other samples is questionable, but probably is not indicative of background concentrations.

Surface soil contamination by inorganic parameters was also documented for some of the Study Area sample locations. Metals that significantly exceeded background concentrations include barium, chromium, iron, lead, and nickel. Cyanide was found in 5 of 11 Study Area samples but was absent in background samples. A summary of the metals detected in surface soil samples is presented in Table 2.

5.2.2 Subsurface Soil Contamination

Subsurface soil samples were also collected in and around the Study Area. These samples were collected using a split-spoon sampler. Sample locations were selected using data from (1) the magnetometer survey; (2) a soil gas survey where organic vapors in soils were measured around the Study Area; (3) seep sampling; and (4) topographic data or other evaluation. Soil borings in the Study


N
SL-23
SL-41 & 42
SL-31
SL-27
SL-32
SL-26
SL-33
SL-43 & 44
SL-28
SL-34
SL-22
SL-29
SL-35
SL 37 & 38
SL-36
SL-30
SL 39 & 40
SL-24
SL-25
800
750
700
650
600
LEGEND
ROADS
STREAMS
STUDY AREA BOUNDARY
● SOIL SAMPLE LOCATION

SCALE
0' 200'

Source: RI Report

SMITH'S FARM
SURFICIAL SOIL SAMPLE LOCATIONS IN THE VICINITY OF THE STUDY AREA

FIGURE 2

Area were located downslope of the known or probable areas of drum disposal.

Soil borings were also made in background locations and in areas outside the Study Area. These borings were selected to either establish background concentrations in subsurface soils, to determine the nature and extent of contaminant migration outside the Study Area, or to evaluate contamination from potential sources located outside the Study Area.

The field sampling protocol for the subsurface soil sampling is presented in the RI report. Samples were selected for analysis and sent to an approved laboratory to determine concentrations of all substances on the target compound list.

Study Area soil boring locations are shown in Figure 3. For discussion purposes, the results of the soil boring analyses will be considered for separate areas of the site.

5.2.2.1 Area C

Samples were collected adjacent to or upslope of this area of potential drum disposal, or in locations near the small streams that are upstream of any potential influence from Area C. The RI report concludes that subsurface soils in the vicinity of Area C are uncontaminated. This conclusion is made notwithstanding the presence of pentachlorophenol at an estimated concentration 0f 2000 ug/kg in one sample near Area C and a concentration of 2500 ug/kg of acetone in another split spoon sample. The conclusion that these sample results are anomalous is based upon visual observations of the site and of magnetometer results from this part of the Study Area.

5.2.2.2 Area B

Highly variable sample results were obtained from four soil borings in Area B. In one soil boring, collected near an area of apparent leachate seepage, the split spoon samples that were analyzed showed subsurface soil contamination by eight volatile organic compounds, as well as two extractable organics. Sample concentrations were generally low, but one sample contained acetone at an estimated concentration of 14,000 ug/kg. A second soil boring located just downslope of an area of drum disposal showed subsurface soil contamination by a variety of organic compounds including PCBs, volatile and extractable organic compounds. Another subsurface soil sample had a very low level of di-n-butyl phthalate present. The

TABLE 1
SUMMARY OF ORGANIC COMPOUNDS DETECTED IN STUDY AREA SURFACE SOILS
SMITH'S FARM SITE

Chemical	Frequency of Detection*	Min.-Max. (ug/kg)	Geometric Mean (ug/kg)	Background Concentration (ug/kg)+
1,1-Dichloroethane	1/18	ND-3J	2	ND
1,2-Dichloroethene	1/18	ND-74	38	ND
Trichloroethene	1/18	ND-4J	2	ND
Toluene	7/18	ND-260	83	140
Ethyl Benzene	1/18	ND-71	37	ND
Total Xylenes	1/18	ND-32000	130	ND
3 and/or 4-Methyl Phenol	1/18	ND-450J	180	ND
Isophorone	2/18	ND-1200	180	ND
Naphthalene	3/18	ND-580	170	ND
2-Methylnaphthalene	3/18	ND-500	170	ND
Dimethyl Phthalate	1/18	ND-82J	43	ND
Di-N Butylphthalate	5/18	ND-370	170	ND
Pyrene	1/18	ND-48J	25	ND
Benzyl Butyl Pththalate	2/18	ND-72J	37	ND
Bis (2-Ethylhexyl) Phthalate	5/18	ND-4200J	1805	ND
Di-N-Octylphthalate	1/18	ND-75J	39	ND
PCB-1248	2/18	ND-200,000	150	ND
PCB-1254	7/18	ND-7200	190	ND
PCB-1260	4/18	ND-1500	180	ND

notes

-For calculations, duplicate samples were averaged to determine a location's concentration.
-The geometric mean was calculated using a value of either 1/2 the detection limit or 1/2 the minimum estimated value if it is less tha the detection limit, for all non-detect samples
-J indicates an estimated value
-ND indicates nondetection
+ Geometric mean of background concentrations
*Frequency of detection is the number of samples with detectable concentrations over the total number of samples

TABLE 2
SUMMARY OF METALS DETECTED IN STUDY AREA SURFACE SOILS
SMITH'S FARM SITE

Metal	Frequency of Detection*	Min.-Max. (mg/kg)	Geometric Mean (mg/kg)	Background Concentration (mg/kg)+
Aluminum	19/19	6200-19000	12000	11000
Antimony	1/7	ND-120JN	16	ND
Barium	19/19	34-6700	150	48
Cadmium	3/19	ND-2.4	0.56	ND
Calcium	2/19	ND-140000	610	ND
Chromium	12/19	22-160	25	ND
Cobalt	2/19	21	10	ND
Copper	1/19	ND-200	11	ND
Iron	19/19	18000-53000	33000	16000
Lead	16/19	9.5J-8900J	55	20
Magnesium	1/19	ND-40000	2100	ND
Manganese	19/19	160-820	270	150
Mercury	12/19	ND-0.5JN	0.26	ND
Nickel	19/19	9.2-52	23	12
Potassium	6/19	ND-4400	1200	ND
Selenium	12/19	ND-1.8J	0.68	0.57
Silver	4/19	ND-3.8J	1.0	ND
Sodium	2/19	ND-86000	110	ND
Vanadium	18/19	ND-34	21	21
Zinc	8/19	ND-540J	91	ND
Cyanide++	5/11	ND-10	.56	ND

notes

-For calculations, duplicate samples were averaged to determine a location's concentration

-The geometric mean concentration was calculated using a value of 1/ the detection limit for all nondetect samples (with the exception of background samples)

-J indicates an estimated value

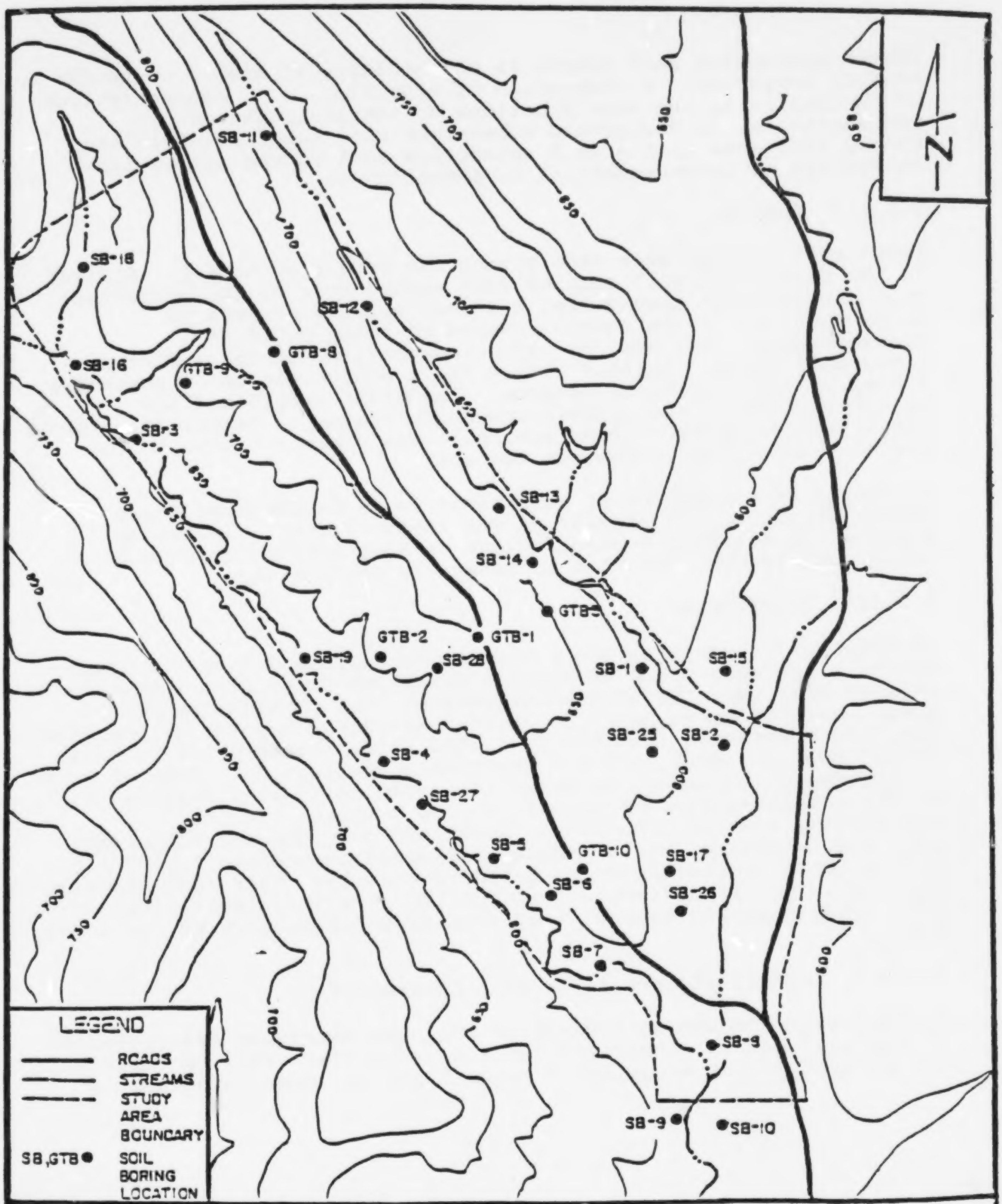
-N means that there is presumptive evidence of the presence of the substance

ND indicates nondetection

+Geometric mean of background concentrations

*Frequency of detection is the number of samples with detectable concentrations over the total number of samples

++Cyanide was the only non-metal inorganic tested


N
800
750
700
650
SB-11
SB-18
SB-12
GTB-8
SB-16
GTB-9
SB-3
SB-13
SB-14
GTB-3
GTB-2
GTB-1
SB-19
SB-28
SB-1
SB-15
SB-25
SB-2
SB-4
SB-27
SB-5
GTB-10
SB-6
SB-17
SB-26
SB-7
SB-8
SB-9
SB-10
600
LEGEND
ROADS
STREAMS
STUDY AREA BOUNDARY
SB,GTB ● SOIL BORING LOCATION

SCALE
0 200'

Source: RI Report

SMITH'S FARM

SOIL BORING LOCATIONS IN THE VICINITY OF THE STUDY AREA

FIGURE
3

fourth subsurface soil sample in the vicinity of Area B contained no organic compounds. A comparison of subsurface soil concentrations of inorganics in the Area B borings to inorganic parameter concentrations in background subsurface soil samples (SB-16 and SB-11) indicates that Area B subsurface soil contamination from inorganics is inconsequential or inconclusive.

5.2.2.3 Area A

Seven soil borings were made around the margin of Area A. Similar to the subsurface soil samples from around Area B, the subsurface soil samples from around Area A showed varying degrees of contamination. Three samples showed no evidence of any contamination. Two samples had concentrations of total PCBs at close to 4 mg/kg. Another sample had a concentration of acetone at 1.8 mg/kg and 1 ug/kg of benzene. The other sample had low concentrations of two organic compounds present. Generally, organic contamination of the subsurface soils was greater closer to the surface rather than deeper in the soil.

Inorganic contamination of subsurface soils around Area A was generally either not present or was insignificant. Individual borings had elevated concentrations of some metals compared to background levels, but this is generally not the case.

5.2.2.4 Other Areas

In addition to sampling the periphery of suspected disposal areas, soil borings were taken in several downslope Study Area locations as well as from near the unnamed tributary, just outside the Study Area. Samples taken near the streams along the margins of the Study Area and downstream from the suspected disposal areas (SB-7, SB-2, SB-15, SB-8 and SB-9) did not indicate contamination. Samples from boring SB-10 indicated contamination potentially attributable to a nearby localized area of drum or refuse dumping. Further downstream, samples from boring SB-20 did not indicate subsurface soil contamination, while samples collected downstream from SB-20 did indicate contamination of subsurface soils. This contamination appears to be attributable to either the permitted landfill or to some other possible source(s) of contamination outside of the Study Area.

5.2.2.5 Summary of Subsurface Soil Contamination

Summary data concerning subsurface soil contamination are presented in Tables 3 and 4. Localized areas of subsurface soil contamination are present in the vicinity of Areas A and B. Based upon the available data, subsurface soil contamination appears to be primarily restricted to areas in close proximity to drum disposal locations. PCBs were found in concentrations greater than 1 mg/kg downslope of both Area A and Area B. Concentrations of acetone exceeding 1 mg/kg were found in samples downslope of Area A and Area B. Contaminant sources (probably the permitted landfill) on the Smith's Farm property outside the Study Area have caused subsurface soil contamination in some locations. Subsurface soil contamination tends to be in shallow rather than deep locations, particularly for the less soluble extractable organic compounds.

5.2.3 Ground-Water Contamination

Ground-water investigations as a part of the RI have been restricted to the uppermost aquifer or saturated zone. Shallow monitoring wells were installed within, and outside of, the Study Area. Well drilling locations were selected based on several factors such as site accessibility, results of the magnetometer and soil gas surveys, and observed areas of contamination.

Ground-water samples were collected in June 1988 and again in December, 1988. Depending on the yield of the well, some or all of the following contaminant classes were monitored during the June sampling effort: volatile organics, metals, extractable organics, PCBs/pesticides, and cyanide. Only organic compounds were checked in the December sampling effort. All sampling was in accordance with EPA Region IV standard operating procedures. Details of the June well sampling are found in the RI report. December sample data are included as an addendum to the RI report.

5.2.3.1 Sampling Results and Data Analysis

Monitoring wells were generally installed in close proximity to the two streams at the margins of the Study Area ("East" and "West" creeks) and along the Unnamed Tributary south of the Study Area (Figure 4). Of the seven wells along the West Creek which were sampled in June, only the two wells adjacent to Area A showed detectable levels of contamination in the shallow ground water (MW-05; MW-06). A third well (MW-8) south of Area A and near the confluence of West Creek and the Unnamed Tributary contained an estimated 200 ug/L of acetone. Near the East Creek, well MW-11 near Area B yielded ground water containing three volatile organic compounds. Well MW-15 is located in the south-central part of the Study Area, downgradient from Area A and approximately

TABLE 3
SUMMARY OF ORGANIC COMPOUNDS DETECTED IN STUDY AREA SUBSURFACE SOILS
SMITH'S FARM SITE

Chemical	Frequency of Detection*	Min.-Max.** (ug/kg)	Geometric Mean (ug/kg)	Background Concentration (ug/kg)
Acetone(0-4 ft)	2/19	ND-14000J	24	ND
(>4 ft)	1/7	ND-1250J	25	ND
1,2 Dichloroethane				
(0-4 ft)	2/19	ND-6J	3	ND
(>4 ft)	1/7	ND-9J	3.5	ND
Methyl Ethyl Ketone				
(0-4 ft)	0/19	ND	--	ND
(>4 ft)	1/7	ND-6J	7.7	ND
Trichloroethene				
(0-4 ft)	2/19	ND-25	3.7	ND
(>4 ft)	1/7	125.5J	5.1	ND
1,1,2-Trichloroethane (0-4 ft)	0/19	ND	--	ND
(>4 ft)	1/7	ND-2.5J	3.7	ND
Benzene(0-4 ft)	1/19	ND-1J	0.5	ND
(>4 ft)	0/7	ND	--	ND
Methyl Isobutyl Ketone (0-4 ft)	0/19	ND	--	ND
(>4 ft)	1/7	ND-215J	10	ND
Tetrachloroethene (0-4 ft)	0/19	ND	--	ND
(>4 ft)	1/7	ND-3.5J	3.1	ND
Toluene(0-4 ft)	1/19	ND-14	7.3	ND
(>4 ft)	0/7	ND	--	ND
Ethylbenzene				
(0-4 ft)	0/19	ND	--	ND
(>4 ft)	1/7	ND-70	4.7	ND
Total xylenes				
(0-4 ft)	1/19	ND-2J	1	ND
(>4 ft)	1/7	ND-450	6.1	ND

notes

** For certain locations, multiple samples were collected within the given depth intervals and are averaged in this table

* Frequency of detection is the number of samples with detectable concentrations over the total number of samples

The geometric mean was calculated using a value of either 1/2 the detection limit or 1/2 the minimum estimated value, for all nondetec samples (with the exception of background samples)

-J indicates an estimated value

-ND indicates nondetection

table continued on the following page

Table 3 continued

Chemical	Frequency of Detection*	Min.-Max.** (ug/kg)	Geometric Mean (ug/kg)	Background Concentration (ug/kg)
(3 &/or 4) Methyl-phenol (0-4 ft)	2/19	46J-64J	25	ND
(>4 ft)	0/7	ND	--	ND
Naphthalene				
(0-4 ft)	1/19	ND-180J	31	ND
(>4 ft)	1/7	ND-28J	28	ND
2-Methylnapthalene				
(0-2 ft)	2/19	ND-120J	16	ND
(>4 ft)	0/7	ND	--	ND
Benzyl Butyl Phthalate				
(0-4 ft)	1/19	ND-1000	218	ND
(>4 ft)	0/7	--	--	ND
Di-N Butyl-Phthalate				
(0-4 ft)	1/19	ND-27.5	14	ND
(>4 ft)	0/7	ND	--	ND
Bis(2-Ethylhexyl) Phthalate				
(0-4 ft)	2/19	ND-2200	245	ND
(>4 ft)	0/7	ND	--	ND
Di-N-Octylphthalate				
(0-4 ft)	1/19	ND-44J	23	ND
(>4 ft)	0/7	ND	--	ND
PCB 1248				
(0-4 ft)	1/19	ND-2700	61	ND
(>4 ft)	0/7	ND	--	ND
PCB 1254				
(0-4 ft)	1/19	ND-1700	116	ND
(>4 ft)	0/7	ND	--	ND
PCB 1260				
(0-4 ft)	3/19	ND-2350	131	ND
(>4 ft)	0/7	ND	--	ND

notes

** For certain locations, multiple samples were collected for given depth intervals and are averaged for this table
* Frequency of detection is the number of samples with detectable concentrations over the total number of samples
The geometric mean was calculated using a value of either 1/2 the detection limit or 1/2 the minimum estimated value, for all nondetect samples (with the exception of background samples)
-J indicates an estimated value
-ND indicates nondetection

TABLE 4
SUMMARY OF METALS DETECTED IN STUDY AREA SUBSURFACE SOILS
SMITH'S FARM SITE

Metal	Frequency of Detection*	Min.-Max. (mg/kg)	Geometric Mean (mg/kg)	Background Concentration (mg/kg)+
Aluminum	19/19	9200-16333J	13460	11806
Antimony	1/14	ND-19J	4.6	ND
Arsenic	19/19	5.1-22.7JN	11.8	12.2
Barium	19/19	23-646	67	55
Cadmium	8/19	ND-13.4JN	1.7	8.1
Calcium	10/19	ND-3690	160	31
Chromium	19/19	15-63	23	17.5
Cobalt	19/19	6.8-26.3	17	14
Copper	9/19	ND-158	8.8	ND
Iron	19/19	22000-76500	36700	26800
Lead	18/18	6.9-482	14.6	7.7
Magnesium	19/19	3100-5670	3760	3240
Manganese	19/19	230-1200	620	450
Mercury	0/19	ND	ND	ND
Nickel	19/19	18-80	32	24.9
Potassium	14/19	ND-2000	550	520
Selenium	0/19	ND	ND	ND
Silver	2/19	ND-3.1	1.7	ND
Sodium	0/19	ND	ND	ND
Vanadium	19/19	20-53	28	26
Zinc	19/19	21.5-1275	83	49.6
Cyanide++	2/19	ND-1.2	0.45	ND

notes

-For certain locations, multiple samples were collected and these samples are averaged for this table

-The geometric mean concentration was calculated using a value of either 1/2 the detection limit or 1/2 the lowest estimated concentration for all nondetect samples

-J indicates an estimated value

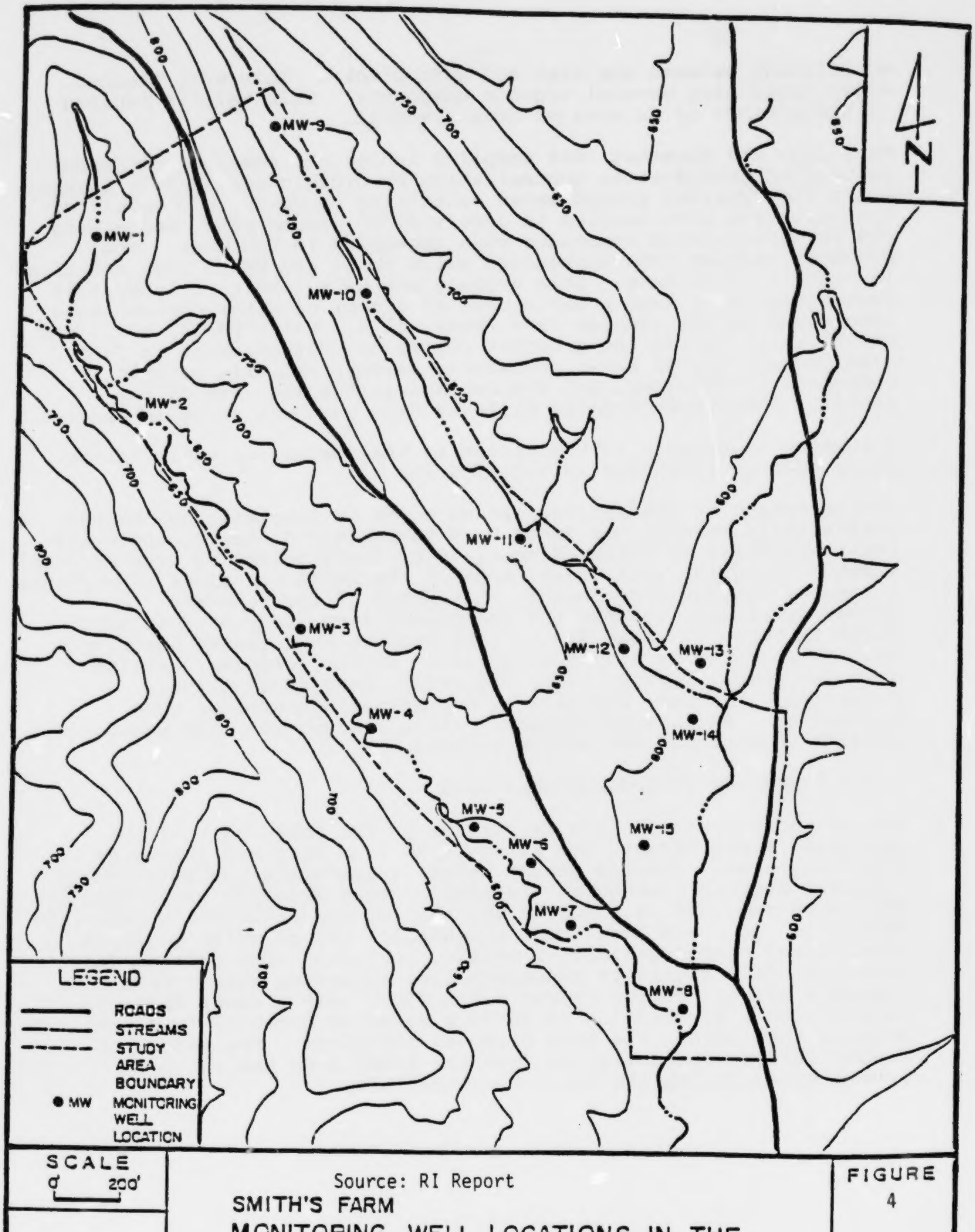
-N means that there is presumptive evidence of the presence of the substance

ND indicates nondetection

+Geometric mean of background concentrations

*Frequency of detection is the number of samples with detectable concentrations over the total number of samples

++Cyanide was the only non-metal inorganic tested


N
MW-1
MW-2
MW-3
MW-4
MW-5
MW-6
MW-7
MW-8
MW-9
MW-10
MW-11
MW-12
MW-13
MW-14
MW-15
800
750
700
650
600
LEGEND
ROADS
STREAMS
STUDY AREA BOUNDARY
● MW MONITORING WELL LOCATION

SCALE
0 200'

Source: RI Report

SMITH'S FARM

MONITORING WELL LOCATIONS IN THE VICINITY OF THE STUDY AREA

FIGURE 4

equidistant between the East and West Creeks. This well yielded water containing several organic compounds. This well is located just downslope of an area of drum disposal.

Data from the December 1988 sampling indicate a somewhat different pattern of ground-water contamination by organic compounds. Several wells that yielded ground water containing no detectable levels of contmaination when sampled in June yielded ground water containing one or more organic compounds when resampled in December. The December samples from background wells MW-01 and MW-09 both contained low levels of toluene. This anomaly may be a result of laboratory contamination or some other source of error; no other contaminants were found in the samples from these wells. Wells MW-05, MW-11 and MW-15, which showed the greatest degree of contamination in June, also yielded ground water containing several volatile organic compounds in December, but the concentrations and some of the specific compounds detected differed from what was found in June.

A summary of organic contamination in shallow ground water in the Study Area is presented in Tables 5 and 6.

Contamination of the shallow ground water by inorganic substances (essentially metals) was noted by a comparison of background wells (MW-1 and MW-9) to wells adjacent to or downgradient of drum disposal areas. Along the East Creek, none of the wells contained significant levles of inorganic compounds. A summary of the relevant ground-water quality data for inorganics from Study Area wells is given in Table 7. From Table 7, it appears that ground water from well MW-06 contains aluminum, arsenic, barium, cadmium, calcium, chromium, cobalt, iron, lead, magnesium, manganese, nickel, potassium, vanadium, and zinc in concentrations greater than background. Well MW-05 contains calcium, magnesium, and sodium in greater than background concentrations.

5.2.3.2 Summary of Ground-Water Data

Ground-water contamination is present in the upper part of the saturated zone, beneath and adjacent to drum disposal locations in the Study Area. Shallow ground water is primarily contaminated by volatile organic compounds. Federal primary drinking water standard MCLs were exceeded in a few of the shallow ground-water samples (see Table 1). In a few locations, the shallow ground water contains significant concentrations of metals, including some primary drinking water standard metals in concentrations exceeding MCLs. From drum disposal areas, shallow ground water flows only a short distance before either discharging as surface seeps or directly into the small streams that border the drum disposal locations. The nature of deeper aquifer contamination from the Study Area has not been investigated during the first Operable Unit.

TABLE 5
SUMMARY OF SHALLOW GROUND-WATER CONTAMINATION BY ORGANIC COMPOUNDS
STUDY AREA MONITORING WELLS- JUNE, 1988
SMITH'S FARM SITE

	Well in Which Detected and Concentration (ug/L)				
Contaminant	MW-05	MW-06+	MW-08+	MW-11	MW-15
Acetone	ND	290J	200J	ND	ND
Benzene	ND	ND	ND	ND	2J
Carbon Disulfide	2J	ND	ND	ND	ND
1,1 Dichloroethane	ND	ND	ND	ND	27
1,2 Dichloroethene	80*	ND	ND	70	70
Di-Nbutylphthalate	ND	ND	ND	ND	6J
Trichloroethene	ND*	ND	ND	56	18
Vinyl Chloride	150	ND	ND	19	10

[illegible]tes

+ Because of the low yield of the well, no extractable organics sample was collected

* The concentration given in the table is the average of two duplicate samples taken from the well

J indicates an estimated value

ND indicates none detected

the background concentration of all organic compounds is ND

TABLE 6
SUMMARY OF SHALLOW GROUND-WATER CONTAMINATION BY ORGANIC COMPOUNDS
STUDY AREA MONITORING WELLS- DECEMBER, 1988
SMITH'S FARM SITE

	Well in Which Detected and Concentration (ug/L)					
Contaminant	**MW-01**	**MW-02**	**MW-03**	**MW-05**	**MW-06**	**MW-07**
Carbon Disulfide	ND	ND	ND	ND	3J	4J
1,1 Dichloroethane	ND	ND	ND	ND	ND	ND
1,1 Dichloroethene	ND	ND	ND	ND	ND	ND
1,2 Dichloroethene	ND	ND	ND	92	ND	ND
Trichloroethene	ND	ND	ND	ND	ND	ND
Chloroethane	ND	ND	ND	ND	ND	ND
Benzene	ND	ND	ND	ND	ND	ND
Toluene	6	ND	3J	ND	ND	4J
Bromochloroethane	ND	ND	ND	10JN	ND	ND
Vinyl Chloride	ND	ND	ND	ND	ND	ND
PCB 1260	ND	0.88J	ND	ND	ND	ND
Unidentified Total Extractable Organics	ND	ND	50	ND	ND	ND

	Well in Which Detected and Concentration (ug/L)						
Contaminant	**MW-08**	**MW-09**	**MW-10**	**MW-11**	**MW-13**	**MW014**	**MW-15**+
Carbon Disulfide	ND	ND	52	ND	10	3J	34
1,1 Dichloroethane	ND	ND	ND	1J	ND	ND	25
1,1 Dichloroethene	ND	ND	ND	2J	ND	ND	ND
1,2 Dichloroethene	ND	ND	ND	230	ND	ND	36.5
Trichloroethene	ND	ND	ND	110	ND	ND	8
Chloroethane	ND	ND	ND	ND	ND	ND	20
Benzene	ND	ND	ND	ND	ND	ND	2J
Toluene	ND	14	6	1J	ND	4J	0.5J
Bromochloroethane	ND	ND	ND	30JN	ND	ND	ND
Vinyl Chloride	ND	ND	ND	150	ND	ND	22
PCB 1260	ND	ND	ND	ND	ND	ND	ND
Unidentified Total Extractable Organics	20J	ND	ND	40J	ND	ND	200J

notes

J indicates an estimated value
ND indicates none detected
+ Concentration given in the table is the average of two duplicate samples
MW-01 and MW-09 are background monitoring wells

TABLE 7
SUMMARY OF SHALLOW GROUND-WATER CONTAMINATION BY INORGANICS
STUDY AREA MONITORING WELLS- JUNE, 1988
SMITH'S FARM SITE

	Well in Which Detected and Concentration (ug/L)			
Contaminant	MW-01*	MW-09*	MW-05+	MW-06
Aluminum	19000	6200	1950	62000
Antimony	ND	ND	ND	ND
Arsenic	10	ND	ND	48
Barium	55	56	16	200
Beryllium	ND	ND	ND	ND
Cadmium	ND	ND	ND	7
Calcium	56000	14000	275000	110000
Chromium	45	14	8	3200
Cobalt	ND	ND	ND	150
Copper	150	11	ND	250
Iron	51000	17000	7900	170000
Lead	13	10	2	94
Magnesium	46000	14000	185000	81000
Manganese	730	700	850	5200
Mercury	ND	ND	ND	ND
Nickel	75	34	ND	2000
Potassium	17000	2500	17000	34000
Selenium	ND	ND	ND	ND
Silver	ND	ND	ND	ND
Sodium	130000	110000	505000	110000
Thallium	ND	ND	ND	ND
Vanadium	30	ND	ND	110
Zinc	250J	84J	115J	910J
Cyanide	ND	ND	ND	NA

notes

*	Background well used for comparison to downgradient wells
+	Concentration given in the table is the average of two duplicate samples
J	indicates an estimated value
ND	indicates none detected
NA	not analyzed

5.2.4 Surface Water Contamination

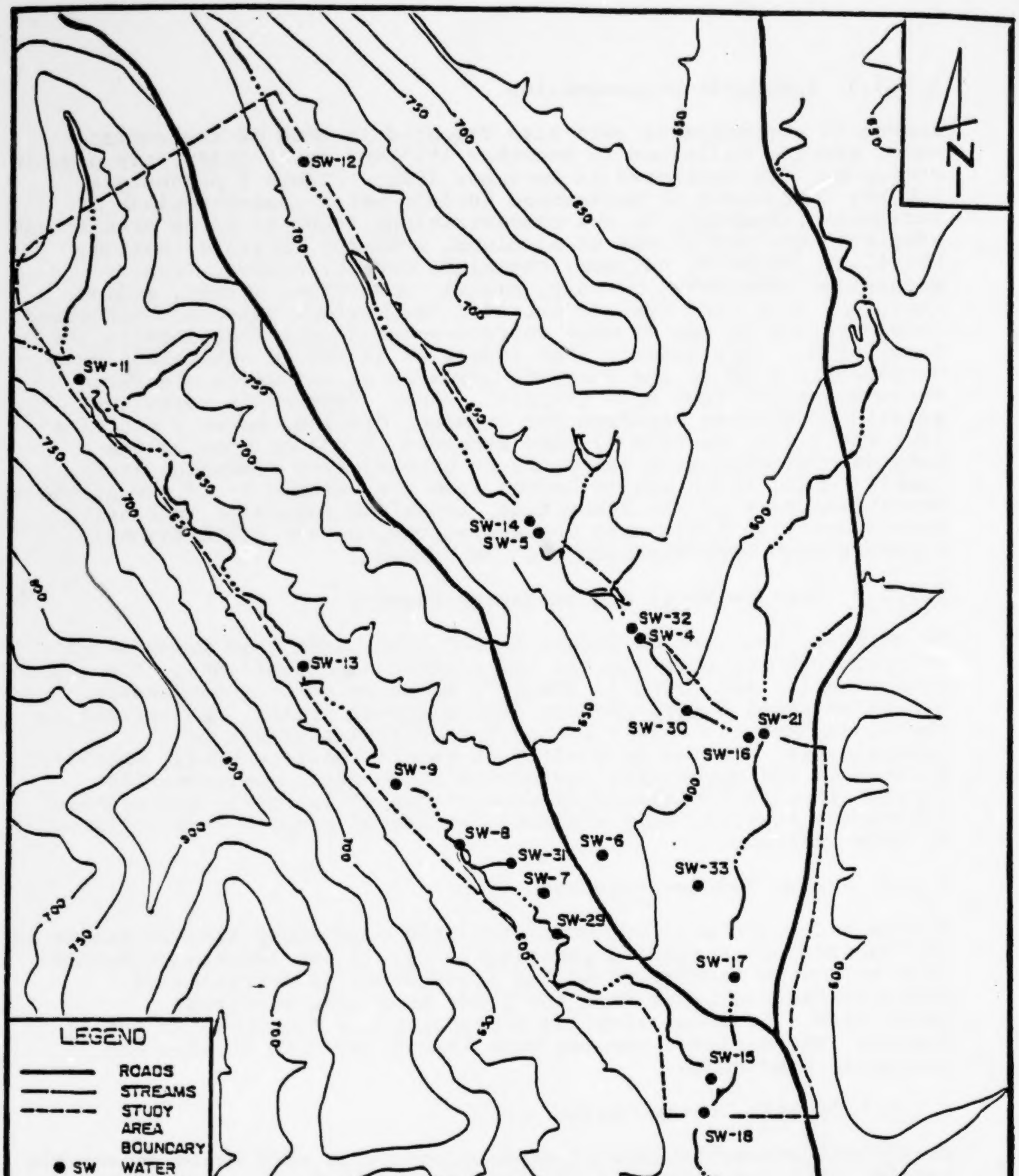
Surface water and stream sediments were sampled during the RI, to determine both the nature of contamination of the streams in the Study Area and to evaluate the migration of contaminants downstream from the Study Area and the Smith's Farm site. This part of the RI included sampling several seeps in the Study Area, as well as the streams draining the Study Area. Sample locations in and around the Study Area are shown in Figure 5. Sampling procedures are described in the RI report.

Surface water samples were collected in December 1987 during a preliminary survey of the site. In April 1988, surface water samples were collected at additional locations in and around the Study Area. A few of the sample stations were resampled in December 1988 for volatile and extractable organic compounds.

5.2.4.1 Organic Contamination

None of the background surface water samples from the December 1987 and April 1988 sampling events contained organic compounds. The December 1988 sample from sample point SW-26, which is just upstream of the road to the Smith's Farm site, contained low levels of two volatile organic compounds and an unidentified extractable organic compound. None of the other locations identified as background were resampled in December 1988.

Several of the surface water samples collected downslope from the Study Area contained organic compounds. The concentrations of the organic compounds in these surface water samples were generally on the order of a few micrograms per liter, although one seep discharging from the east side of Area A contained a total volatile organic concentration (mostly methyl isobutyl ketone) of over 36,000 ug/l in December 1987 and the total concentration of thirteen volatile organics in a ponded area on the south side of Area A exceeded 6,000 ug/l in April 1988. Kentucky's warmwater aquatic protection criteria for PCBs (401 KAR 5:031 Section 4) were exceeded in samples collected from several seeps or other ground- water discharge areas downslope from the drum disposal areas. Organic contaminants were detected in both the East and West Creeks at the margin of the Study Area. Samples collected downstream from the confluence of these streams with the Unnamed Tributary contained either relatively low concentrations of organic compounds or contained non-detectable levels of organic compounds. Only two Study Area stream sample locations were resampled in December 1988. The sample from location SW-17 contained no organic compounds in December 1988, while the sample from location SW-18 contained an estimated concentration of 2 ug/l of chloromethane. A summary of organic compounds detected in surface water samples collected in December 1987 and April 1988 is presented in Table 8.


N
SW-12
SW-11
SW-14
SW-5
SW-32
SW-4
SW-13
SW-30
SW-21
SW-16
SW-9
SW-8
SW-31
SW-6
SW-7
SW-33
SW-29
SW-17
SW-15
SW-18
750
700
650
600
LEGEND
ROADS
STREAMS
STUDY AREA BOUNDARY
● SW WATER SAMPLE LOCATION

SCALE
0' 200' 400'

Source: RI Report

FIGURE
5

SMITH'S FARM
SURFACE WATER SAMPLE LOCATIONS IN THE VICINITY OF THE STUDY AREA

5.2.4.2 Inorganic Contamination

Inorganic contaminants were also detected in some of the surface water samples collected in December 1987 and April 1988 (only organic compounds were monitored in December 1988). Table 9 presents a summary comparison of background surface-water concentrations of inorganic parameters to the concentrations found in Study Area stream samples. Concentrations of aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, magnesium, manganese, mercury, nickel, potassium, silver, sodium, vanadium, zinc, and cyanide exceeded the maximum detected background concentration at one or more surface-water sample locations in the Study Area. Particularly high levels of inorganic substances were detected in some of the leachate seeps or ground-water discharge areas downslope from drum disposal areas. Kentucky's warmwater aquatic protection criteria for cadmium, cyanide, mercury and zinc (401 KAR 5:031, Section 4) were exceeded in one or more of the samples collected from the seeps or ground-water discharge areas. Sample SW-18, which was collected from the Unnamed Tributary at the downstream part of the Study Area, contained levels of inorganics consistent with background concentrations, except for a slightly higher sodium concentration than background.

5.2.4.3 Surface Water Contamination Summary

In summary, the surface waters in the Study Area show evidence of contamination by both organic and inorganic contaminants. The worst contamination was found in leachate seeps or other ground-water discharge areas downslope from drum disposal areas. The streams in the Study Area had fairly low or insignificant levels of contaminants. The water quality at sample location SW-18, which is located at the downstream end of the Study Area, was generally consistent with background concentrations of inorganic and organic compounds; however, only a limited number of samples were collected at this location.

5.2.5 Stream Sediment Contamination

Stream sediments were collected from the same Study Area locations as the surface water samples (see Figure 5). A few additional samples were collected downstream of the Study Area, to determine if contaminated sediments from the Study Area were migrating downstream. Sediment sampling procedures are described in the RI report. The sediment samples were tested for both organic and inorganic substances.

5.2.5.1 Organic Contamination

Background concentrations of organic compounds were below detectable levels, with the exception of chloroform, which was detected in several background samples (an average concentration of 1.4 micrograms per kilogram (ug/kg), and di-n-octyl phthalate, which was

TABLE 8
SURFACE WATER CONTAMINATION by ORGANIC COMPOUNDS
DECEMBER 1987 and APRIL 1988
SMITH'S FARM SITE

	Sample Location and Concentration (ug/l)						
Contaminant	SW-05	SW-06	SW-07	SW-08	SW-09	SW-14	SW-16
Acetone	8100N	ND	ND	ND	ND	ND	ND
1,2 Dichloroethene	850J	ND	31	ND	ND	46	11
Trichloroethene	ND	ND	3J	ND	ND	30	10
Methyl Isobutyl Ketone	30000J	ND	ND	ND	ND	16	ND
Toluene	ND	ND	ND	ND	ND	8	ND
Chlorobenzene	ND	ND	ND	ND	ND	1J	ND
Ethyl Benzene	ND	ND	ND	ND	ND	42	ND
Total Xylenes	5200	ND	ND	ND	ND	ND	ND
Isophorone	71	ND	ND	ND	ND	ND	ND
Benzoic Acid	ND	ND	ND	13J	ND	ND	ND
Naphthalene	440	ND	ND	ND	ND	ND	ND
2 Methylnaphthalene	61	ND	ND	ND	ND	ND	ND
Acenaphthene	40	ND	ND	ND	ND	ND	ND
Fluoranthene	ND	25J	ND	ND	2J	ND	ND
PCB-1242	5.5J	ND	ND	ND	ND	ND	ND
PCB-1254	10J	ND	ND	ND	ND	ND	ND
PCB-1260	15J	ND	ND	ND	ND	ND	ND

notes:

J indicates an estimated value
N indicates presumptive evidence of material
The concentration for sample SW-06 is an average of two duplicate samples
ND indicates none detected

Table 8 is continued on the following page

Table 8 continued

	Sample Location and Concentration (ug/l)					
Contaminant	SW-17	SW-29	SW-30	SW-31	SW-32	SW-33
Vinyl Chloride	ND	ND	ND	ND	ND	48
Chloroethane	ND	ND	ND	3J	ND	ND
1,1 Dichloroethene	ND	ND	ND	ND	ND	3J
1,1 Dichloroethane	ND	ND	ND	9	ND	3J
1,2 Dichloroethene	1J	ND	27	4J	ND	790
Methyl Ethyl Ketone	ND	ND	ND	26J	ND	580J
1,1,1 Trichloro-ethane	ND	ND	ND	5J	ND	22
Benzene	ND	ND	ND	3J	ND	1J
Methyl Isobutyl Ketone	ND	ND	3J	58J	ND	1500
Tetrachloroethene	ND	ND	ND	2J	ND	14
Toluene	ND	1.5J	ND	420J	1.5J	980
Ethyl Benzene	ND	ND	ND	28J	ND	310
Total Xylenes	ND	ND	ND	170J	26	1700
Phenol	ND	ND	ND	ND	ND	8J
Benzyl Alcohol	ND	ND	ND	9J	ND	ND
2 Methyl Phenol	ND	ND	ND	110	ND	13J
3 and/or 4 Methyl Phenol	ND	ND	ND	43	ND	14J
Isophorone	ND	ND	ND	96	ND	12J
2,4-Dimethylphenol	ND	ND	ND	12J	ND	6J
Benzoic Acid	ND	ND	ND	87J	ND	91J
Naphthalene	ND	ND	ND	15J	ND	8J
PCB-1260	ND	ND	ND	ND	ND	2.7

notes:

J indicates an estimated value
The concentration for samples SW-29 and SW-32 is the average of two duplicate samples
ND indicates none detected

TABLE 9
SURFACE WATER CONTAMINATION BY INORGANIC SUBSTANCES
DECEMBER 1987 AND APRIL 1988
SMITH'S FARM SITE

	Background (n=5)		Study Area (n=17)	
	Concentration		Concentration	
Contaminant	Range	Median	Range	Median
Aluminum	ND-350	ND	ND-37000	420
Antimony	ND	ND	ND-160JN	ND
Arsenic	ND	ND	ND-15J	ND
Barium	ND	ND	ND-1500	ND
Beryllium	ND	ND	ND-2	ND
Cadmium	ND	ND	ND-52JN	ND
Calcium	6200J-16000J	10000J	ND-110000	9600
Chromium	ND	ND	ND-95J	ND
Cobalt	ND	ND	ND-100	ND
Copper	ND	ND	ND-140	ND
Iron	ND-700J	ND	ND-330000	3200
Lead	ND	ND	ND	ND
Magnesium	4700-7400	5800	ND-45000	6700
Manganese	ND-44	ND	ND-7500	43
Mercury	ND	ND	ND-0.92JN	ND
Nickel	ND	ND	ND-16	ND
Potassium	ND-2400	1800	ND-40000	2600
Selenium	ND	ND	ND	ND
Silver	ND	ND	ND-13	ND
Sodium	ND	ND	ND-170000	9400
Thallium	ND	ND	ND	ND
Vanadium	ND	ND	ND-130	ND
Zinc	ND	ND	ND-930	ND
Cyanide	ND	ND	ND-20J	ND

notes

J indicates an estimated value
N presumptive evidence of presence of material
ND indicates none detected
n is the number of samples

found at a concentration of 150 ug/kg in one background sample. The low levels of chloroform detected may be the result of laboratory contamination; an upslope residential area is a potential source of the phthalate compound that was detected.

Generally, organic compounds, if present in Study Area sediment samples, were low solubility extractable compounds rather than the volatile organics. PCBs were found in several Study Area sediment samples. Several Study Area surface-water sample locations showed low or insignificant levels of organic compounds, yet the sediment samples collected from these areas contained relatively high levels of organics. Either the transport of organic compounds bound to sediments into the streams around the Study Area has occurred, or less soluble aqueous phase organics are bound to sediments soon after entering the streams, or both. Contaminated sediments may then be washed downstream. Table 10 summarizes the organic contaminants found in Study Area sediments. The background concentrations of all organic compounds in sediments are presumed to be below detection limits. Table 11 compares Study Area to downstream concentrations of organic compounds in sediments.

5.2.5.2 Inorganic Contamination

Some inorganic parameters were found in Study Area sediments at concentrations above background values. Overall, however, sediment contamination by inorganics is relatively minor. Table 12 summarizes the sediment contamination by inorganic substances. Median concentrations of all the inorganics are virtually equivalent between background and Study Area samples. However, several of the inorganics, most notably barium, cadmium, chromium, and lead, exceeded background levels in one or more sediment samples from the Study Area. Table 13 compares Study Area to downstream concentrations of inorganic substances.

5.2.6 Summary of the Study Area Contamination

Contamination of surface and subsurface soil, ground water, surface water, and stream sediments was found in the Study Area at Smith's Farm. Contaminants found in soil include volatile organic compounds, extractable organic compounds, metals, and cyanide. Organic compounds were found in both surface and subsurface soils, while soil contamination by inorganic parameters was restricted to surface soils. Shallow ground water is primarily contaminated with volatile organic compounds. A few shallow ground-water samples contained extractable organic compounds, and two ground water samples showed contamination with metals. Surface waters in the Study Area are contaminated with volatile organic compounds, extractable compounds, metals, and cyanide. Surface-water contamination was most significant in seeps or other ground-water discharge areas just downslope from drum disposal locations in the Study Area. Surface-water samples collected in the downstream part of the Study

TABLE 10
SEDIMENT CONTAMINATION BY ORGANIC COMPOUNDS
SMITH'S FARM SITE- STUDY AREA

Contaminant	Number of Detections/Number of Samples	G.Mean Conc.	Maximum Conc./ Sample Location
1,1 Dichloroethane	2/17	4	12J/SD-33
1,2 Dichloroethene	4/17	5.5	1500/SD-33
1,1 Dichloroethene	1/17	4	7J/SD-33
Chloroform	11/17	2	3.5/SD-29*
Trichloroethene	5/17	5.9	570J/SD-33
Toluene	4/17	6.3	2400/SD-33
Total Xylenes	3/17	10.4	25000/SD-33
Vinyl Chloride	1/17	9.5	110/SD-33
Chloroethane	1/17	8.4	13J/SD-31
Acetone	1/17	22	1200J/SD-33
Methyl Ethyl Ketone	1/17	na	1400J/SD-33
1,1,1 Trichloroethane	1/17	4.2	20/SD-33
1,1,2 Trichloroethane	1/17	4	5J/SD-33
Benzene	2/17	4	8J/SD-31
Methyl Isobutyl Ketone	1/17	11	1800J/SD-33
Methyl Butyl Ketone	1/17	7.8	8J/SD-33
Tetrachloroethene	1/17	4.5	39/SD-33
Chlorobenzene	1/17	1.6	3J/SD-31
Ethyl Benzene	2/17	6.9	3100/SD-33
2 Methyl Phenol	1/17	57	110J/SD-33
3 and/or 4 Methyl Phenol	1/17	229	440J/SD-33
Isophorone	1/17	133	255/SD-29*
2-Dimethyl Phenol	1/17	34	66J/SD-33
Di-N Butyl Phthalate	1/17	4166	8000J/SD-33
Benzyl Butyl Phthalate	4/17	514	2200/SD-31

notes

all concentrations in ug/kg
* Average of two duplicate samples
na not applicable
J indicates an estimated value
N presumptive evidence of presence of material
Geometric Mean (G.Mean) calculated by using either 1/2 the detection limit, or 1/2 the the lowest estimated concentration, if below the detection limit, for all non-detect samples

table 10 continued on the following page

table 10 continued

	Number of Detection/Number of Samples	G.Mean Conc.	Max. Conc./ Sample Location
Bis 2 Ethyl Hexyl Phthalate	4/17	1610	69000JN/SD-07
Benzo B/K Fluoranthene	1/17	524	34000J/SD-06
Benzo-A-Pyrene	1/17	523	21000J/SD-06
Dibenzo(A,H)Anthracene	1/17	524	29000J/SD-06
Benzo(GHI)Perylene	1/17	524	36000J/SD-06
PCB 1248	1/17	122	2000J/SD-14
PCB 1254	1/17	173	2350J/SD-06
PCB 1260	9/17	363	2200/SD-33
Benzoic Acid	1/17	46	88J-SD-29
Naphthalene	2/17	448	940/SD-31
2-Methylnaphthalene	2/17	71	150J/SD-31
Pyrene	1/17	575	2100/SD-31
Benzo(A)Anthracene	1/17	552	1100/SD-31

notes

all concentrations in ug/kg
J indicates an estimated value
N indicates presumptive evidence of the presence of material
Geometric mean (G. Mean) calculated by using either 1/2 the detection limit or 1/2 the lowest estimated concentration, if below the detection lmit, for all non-detect samples

TABLE 11
COMPARISON OF STUDY AREA TO DOWNSTREAM SEDIMENT CONTAMINATION BY ORGANIC COMPOUNDS
SMITH'S FARM SITE

	Study Area Concentrations		Downstream Concentrations	
Contaminant	G. Mean	Maximum	G. Mean	Maximum
1,1 Dichloroethane	4	12J	3.6	6
1,2 Dichloroethene	5.5	1500	ND	
1,1 Dichloroethene	4	7J	ND	
Chloroform	2	3.5	ND	
Trichloroethene	5.9	570J	ND	
Toluene	6.3	2400	ND	
Total Xylenes	10.4	25000	ND	
Vinyl Chloride	9.5	110	ND	
Chloroethane	8.4	13J	ND	
Acetone	22	1200J	ND	
Methyl Ethyl Ketone	na	1400J	ND	
1,1,1 Trichloroethane	4.2	20	3.7	7
1,1,2 Trichloroethane	4	5J	ND	
Benzene	4	8J	ND	
Methyl Isobutyl Ketone	11	1800J	ND	
Methyl Butyl Ketone	7.8	8J	ND	
Tetrachloroethene	4.5	39	ND	
Chlorobenzene	1.6	3J	ND	
Ethyl Benzene	6.9	3100	ND	
2 Methyl Phenol	57	110J	ND	
3 and/or 4 Methyl Phenol	229	440J	ND	
Isophorone	133	255	ND	
2-Dimethyl Phenol	34	66J	ND	
Di-N Butyl Phthalate	4166	8000J	ND	
Benzyl Butyl Phthalate	514	2200	ND	
Bis 2 Ethyl Hexyl Phthalate	1610	69000JN	ND	
Benzo B/K Fluoranthene	524	34000J	770	3900

notes

all concentrations in ug/kg
* Average of two duplicate samples
na not applicable
J indicates an estimated value
N presumptive evidence of presence of material
ND indicates none detected
Geometric mean (G. Mean) calculated by either using 1/2 the detection limit or 1/2 the minimum estimated value, if less than the detection limit for all non-detect samples

---

table continued on the following page

table 11 continued

	Study Area Concentrations		Downstream Concentrations	
Contaminant	G. Mean	Maximum	G. Mean	Maximum
Benzo-A-Pyrene	523	21000J	430	1900
Dibenzo(A,H)Anthracene	524	29000J	380	650
Benzo(GHI)Perylene	524	36000J	480	1600
PCB 1248	122	2000J	ND	
PCB 1254	173	2350J	ND	
PCB 1260	363	2200	ND	
Indeno (1,2,3-CD)Pyrene	ND		460	1300
Benzoic Acid	46	88	ND	
Naphthalene	448	940	258	350
2 Methylnaphthalene	71	150	50	160
Dibenzofuran	ND		320	6600
Fluorene	ND		330	610
Phenanthrene	ND		660	7100
Anthracene	ND		420	1600
Fluoranthene	ND		820	7100
Pyrene	575	2400	780	5900
Benzo(A)Anthracene	552	1100	450	2400
Chrysene	ND		520	3600

notes

all concentrations in ug/kg
J indicates an estimated value
ND none detected
Geometric mean (G. Mean calculated using either 1/2 the detection limit or 1/2 the minimum estimated value, if below the detection limit, for all non-detect samples

TABLE 12
SEDIMENT CONTAMINATION BY INORGANIC SUBSTANCES
SMITH'S FARM SITE

Contaminant	Background (n=5) Concentration (ug/kg) Range	Median	Study Area (n=19) Concentration (ug/kg) Range	Median
Aluminum	9300J-12000J	11000J	7400J-16500J*	11000J
Antimony	ND-3.5J	ND	ND	ND
Arsenic	ND-18JN	12JN	ND-56	8.2
Barium	54J-78J	69J	47-2300J	95J
Beryllium	ND	ND	ND	ND
Cadmium	ND	ND	ND-6.3JN	ND
Calcium	ND-6100J	1200J	ND-23000J	1200J
Chromium	15J-19J	17J	12J-120J	20J
Cobalt	ND-21	17	ND-28	17J
Copper	ND	ND	ND-21	ND
Iron	24000J-52000J	28000J	18000J-110000J	31000J
Lead	14J-16J	14J	ND-990J	19J
Magnesium	2400J-6200	3000J	1800-15000J	3300J
Manganese	440J-1000J	620J	140J-1600J	460J
Mercury	ND	ND	ND	ND
Nickel	21-29	25	ND-57	19
Potassium	1500J-2100J	1900J	730J-3150J*	1700J
Selenium	ND	ND	ND	ND
Silver	ND-1.5J	ND	ND-1.4J	ND
Sodium	ND	ND	ND-730	ND
Thallium	ND	ND	ND	ND
Vanadium	21-26	23	ND-39	25
Zinc	61J-110J	85J	72J-380J	105J*
Cyanide	ND	ND	ND	ND

notes

*Indicates an average for a duplicate sample location
ND incates not detected
J indicates an estimated value
n is the number of samples

TABLE 13
COMPARISON OF STUDY AREA TO DOWNSTREAM SEDIMENT CONTAMINATION by INORGANIC SUBSTANCES
SMITH'S FARM SITE

Contaminant	Downstream Concentration (ug/kg) Range	Median	Study Area Concentration (ug/kg) Range	Median
Aluminum	7700J-15000J	13000J	7400J-16500J*	11000J
Antimony	ND	ND	ND	ND ND
Arsenic	5.7JN-45JN	17JN	ND-56	8.2
Barium	ND-120J	80J	47-2300J	95J
Beryllium	ND	ND	ND	ND
Cadmium	ND-5.3JN	ND	ND-6.3JN	ND
Calcium	1800-15000J	4400J	ND-23000J	1200J
Chromium	18J-33J	23J	12J-120J	20J
Cobalt	15-30	21	ND-28	17J
Copper	ND-14	ND	ND-21	ND
Iron	31000J-97000	69000J	18000J-110000J	31000J
Lead	ND-110J	26J	ND-990J	19J
Magnesium	3000-11000J	5400J	1800-15000J	3300J
Manganese	250J-1500J	710J	140J-1600J	460J
Mercury	ND	ND	ND	ND
Nickel	ND-110	57	ND-57	19
Potassium	1300J-4500J	2300J	730J-3150J*	1700J
Selenium	ND	ND	ND	ND
Silver	ND-1.6J	ND	ND-1.4J	ND
Sodium	ND-190	ND	ND-730	ND
Thallium	ND	ND	ND	ND
Vanadium	24-45	27	ND-39	25
Zinc	92J-260J	170J	72J-380J	105J*
Cyanide	ND	ND	ND	ND

notes

*Indicates an average for a duplicate sample location
ND incates not detected
J indicates an estimated value
N indicates presumptive evidence of the presence of material

Area indicate that the surface-water contamination there does not represent a significant pathway; however, only a limited number of samples have been collected to support this conclusion. Stream sediments are primarily contaminated by organic compounds. The highest levels of sediment contamination are found in areas of ground-water discharge immediately downslope from drum disposal areas. Contaminated sediments may be washed downstream, especially during periods of heavy runoff.

The vertical extent of ground-water contamination was not determined in the first operable unit Remedial Investigation. The nature of deeper ground- water contamination will be investigated in a second operable unit RI/FS. In the interim, potential downgradient ground-water receptors are being monitored quarterly. Contamination emanating from the permitted landfill at Smith's Farm will also be investigated in the second RI/FS; preliminary results indicate that the landfill is the source of some environmental contamination. Other areas of suspected drum disposal will also be investigated in the second RI/FS.

Three areas of suspected drum disposal were investigated in the RI. Areas A and B (identified in the RI report) were found to be sources of contamination and will be part of the planned remedial action for the Study Area. Area C was not found to be a significant source of contamination and no remedial activities will be required for that part of the Study Area.

Several ground-water and surface-water standards are exceeded in some sample locations in the Study Area. The chemicals for which water quality standards are exceeded are listed in Table 14 of this document.

6.0 SUMMARY OF SITE RISKS

6.1 Introduction

As a part of the Remedial Investigation of the Smith's Farm site, an Endangerment Assessment (EA) was performed in order to evaluate the potential human health and environmental impacts and risks associated with the Smith's Farm site. The EA documented the potential and probable risks to human health and the environment that would occur if no action was taken to remediate the contamination in the Study Area.

The EA included the following information:

- Identification of chemicals of potential concern- the chemical toxicity and chemical distribution in the environment
- The exposure pathways from each of the contaminated environmental media
- The human health risks posed by the chemicals
- The risks to the environment posed by the chemicals

TABLE 14
SUBSTANCES EXCEEDING WATER-QUALITY CRITERIA IN THE STUDY AREA

Substance of Concern	Media of Concern and Potential ARAR Exceeded	
	Ground Water	Surface Water
Vinyl Chloride	MCL[+]	MCL
Acetone	--	FCC[#]
Trichloroethene	MCL	MCL
Benzene	MCL	--
Cresols	--	FCC,WAHC[*]
Polychlorinated Biphenyls (PCBs)	--	FCC,WAHC
Chromium	MCL	MCL
Lead	MCL	--
Mercury	--	FCC,WAHC
Zinc	--	FCC,WAHC

WATER-QUALITY : CRITERIA

[+] MCL- Maximum contaminant level. MCLs are enforceable drinking water standards under the federal Safe Drinking Water Act.

[#] FCC- Freshwater chronic criteria. These are water quality criteria developed under the Clean Water Act for the protection of aquatic life.

[*] WAHC-Warmwater aquatic habitiat criteria for the Commonwealth of Kentucky, included in Kentucky Administrative Regulations, Title 401, Chapter 5:031.

-- indicates that criterion is either not applicable or is not exceeded

Risks posed by the chemicals in the Study Area were estimated for both a "current use scenario" and a "future use scenario". The "current use scenario" considered the exposures and risks that nearby residents are subject to or could be subject to under present conditions. The "future use scenario" considered the risks that would be posed to future residents living both on and off site if no remedial actions were taken and the site use was unrestricted.

EPA risk assessment guidance and generally accepted risk assessment methods were used to estimate the risks posed by an "average exposure" case and a "plausible maximum exposure" case. The EA used generally conservative assumptions and methods to estimate the risks posed by the site. Assumptions and methods used in the risk assessment are described in more detail in Section 6.2.

6.2 Assumptions and Methods of Analysis

6.2.1 Exposure

Assumptions were made about human exposure to contaminants in order to calculate the risks posed by the current-use and future-use scenarios. Under the current use-scenario, persons potentially exposed to contaminants on site are hunters who may be exposed to contaminated soils through direct contact or incidental soil ingestion; hunters or other site trespassers or neighborhood children who may be exposed by direct contact to contaminated surface water; and trespassers who may be exposed to organics in the air, primarily through volatization from surface waters on site. Dirt-bike riders trespassing onto the site may be exposed to contaminated soils through dust generation. Potential exposures to persons off site under the current use scenario are limited to ground water exposure (ingestion, dermal contact and inhalation of volatilized organics are potential pathways) or to children who may wade in Blue Lick creek.

Under the future-use scenario, the site is assumed to potentially have residents living on site. Under these conditions, young children could absorb contaminants through the skin or ingest contaminated soil through hand to mouth activity while playing on site. Adults living on site could ingest incidental amounts of soil after gardening or minor construction projects. Human exposure to contaminated air, surface water and sediment is assumed to be the same as for the current-use scenario. Exposure to contaminated ground water could occur if on site residents install wells into the shallow aquifer in the area.

For all environmental media (soil, air, surface water, etc.), two exposure scenarios were calculated. One exposure scenario was the average case, based upon geometric mean concentrations. A plausible maximum exposure scenario was considered to be related to the maximum contaminant concentration found on site. For the exposure to dust generated by dirt bike riding, the average case assumed an exposure from one dirt bike riding through the site for one hour, while the plausible maximum case assumed that three dirt bikes were riding through the site for two hours.

In estimating exposure to site trespassers, it was assumed that the site would be traversed once per week for forty weeks per year for the average case and twice per week for 40 weeks per year for the plausible maximum case. The total duration of exposure was assumed to be 10 years and 55 years for the average and maximum plausible cases respectively.

Contact with surface water and sediments by children off site assumed that children between the ages of 7 and 17 could be exposed by wading in Blue Lick Creek. The period of exposure was assumed to be 5 years

for the average case and 10 years for the maximum plausible case. In the average case, the exposure was estimated to be 40 times per year while the exposure was estimated to be 80 times per year for the maximum plausible case.

For future-use residents, it was assumed that exposure to on-site soils would occur for 10 years in the average case and for 55 years in the maximum plausible case. The frequency of exposure to soils was considered to be a function of age.

If site conditions limit future-use development (for example, slope stability might limit areas of the site where an individual might build a house), only the chemical concentrations within the area where development might occur were considered in the risk assessment.

Rates for soil ingestion; soil bioavailability (percentage of ingested soil actually absorbed); dermal absorption from soils, sediments, and contaminated water; and inhalation of volatile organics from contaminated water were determined from references. Dermal absorption was assumed to occur for organic compounds only, based upon the literature review. Ingestion exposure for contaminated ground water was estimated based on the EPA standard assumption of the intake of 2 liters of water per day by a 70-kilogram individual.

Volatization of organic compounds from surface water into the air was estimated using a model. The flux rate from water to air was determined by multiplying the mass transfer coefficient for a chemical by the concentration of that chemical in the water. The flux rate was then multiplied by the area of surface water to get a contaminant emission rate. The surface water area was conservatively estimated to be 2,450 m^2 based on the location of samples that were collected.

6.2.2 Chemicals

Several assumptions were made when considering the chemical data generated in the RI that would be used in the risk assessment:

- Certain chemicals are frequently laboratory contaminants and are often detected in "blank" samples used for environmental quality control purposes. For these common contaminants, concentrations in on-site samples that were less than 10 times the concentrations in an associated field or trip blank were considered non-detects for purposes of the risk assessment. For other contaminants, concentrations less than 5 times the concentrations detected in associated field or trip blanks were considered non-detects.
- Estimated concentrations ("J" or "N"-flagged values) were treated as actual concentrations for the risk assessment. "R"-flagged data (indicating quality control problems) were not used.
- Geometric mean values were estimated for media in which a chemical was detected in one or more samples by considering non-detect concentrations equal to one-half the sample-specific detection limit.
- Concentrations for duplicate samples were calculated as the geometric mean of the two measurements.
- Inorganic background data used for comparisons to on-site soil concentrations are site-specific, unless sufficient data for statistical comparisons were unavailable. In such cases, background data for soils were taken from published U.S. Geological Survey values.
- Chemicals with a frequency of detection less than 5% were not considered in the risk assessment.
- Only chemicals with human health toxicity values were included in the quantitative evaluations of human-health impacts.

6.2.3 Risks

To determine the risks to human health, a non-threshold carcinogen model was used. This model assumes that there is no threshold value below which a carcinogen has no potential for carcinogenicity. For non-carcinogens, it was assumed that there is a threshold below which no human health effects would occur.

To assess the risks to human health and the environment posed by the site, the concentrations of chemicals in relevant environmental media at points of potential exposure were converted to chronic daily intakes (CDIs). CDIs are expressed as the amount of substance taken into the body per unit body weight per unit time (mg/kg/day). The CDIs were averaged over a lifetime for carcinogens and over the exposure period for non-carcinogens, in accordance with EPA guidance.

To evaluate risks to human health from carcinogens, the risk assessment considered the cancer potency factors for the known or suspected carcinogenic chemicals found in the Study Area. Cancer potency factors (CPFs) have been developed by EPA's Carcinogenic Assessment Group for estimating the excess lifetime cancer risk associated with exposure to known or potentially carcinogenic chemicals. CPFs, which are expressed in units of $(\text{mg/kg-day})^{-1}$ are multiplied by the estimated intake of a potential carcinogen in mg/kg-day to provide an upper-bound estimate of the excess lifetime cancer risk associated with exposure at that intake level. The term "upper bound" reflects the conservative estimate of the risks calculated from the CPF. Use of this approach makes underestimation of the actual cancer risk highly unlikely. Cancer potency factors are derived from the results of human epidimiological studies or chronic animal bioassays to which animal-to-human extrapolation and uncertainty factors have been applied.

To evaluate the risks from non-carcinogens, the risk assessment considered the reference doses for non-carcinogenic chemicals found in the Study Area. Reference doses (RfDs) have been developed by EPA for indicating the potential for adverse health effects from exposure to chemicals exhibiting noncarcinogenic effects. RfDs, which are expressed in units of mg/kg-day, are estimates of lifetime daily exposure levels for humans, including sensitive individuals, that are unlikely to be without an appreciable risk of adverse health effects. Estimated intakes of chemicals from environmental media (e.g., the amount of a chemical ingested from contaminated drinking water) can be compared to the RfD. RfDs are derived from human epidimiological studies or animal studies to which uncertainty factors have been applied (e.g., to account for the use of animal data to predict effects on humans). These uncertainty factors help ensure that the RfDs will not underestimate the potential for adverse noncarcinogenic effects to occur.

Potential risks for non-carcinogens were determined by calculating the ratio of the CDI to the reference dose (CDI:RfD). THe sum of all of the ratios of chemicals under consideration is called the hazard index. A hazard index of less than one is assumed to not be associated with any significant health risks, although the degree of uncertainty involved in risk and intake calculations leaves some doubt as to what is actually a "safe" hazard index.

In accordance with EPA's guidelines for evaluating the toxicity of complex mixtures, toxic effects of chemicals were assumed to be additive. Therefore, lifetime excess cancer risks and the CDI:RfD ratios were summed to indicate potential risks associated with mixtures of carcinogens and non-carcinogens respectively.

6.3 Contaminants Considered in the Risk Analysis

6.3.1 Surface Soils

Eighteen organic and twenty inorganic contaminants were detected in the surface soil samples collected in the Study Area. Dimethyl phthalate was detected in only one sample and was not detected in any other medium and was eliminated as a chemical of potential concern. Di-n-octylphthalate was also not considered as a chemical of potential concern. The remaining organic chemicals were considered of potential concern and were retained in the risk assessment. The organic chemicals of concern and their concentrations are presented in Table 1 of the ROD.

Lead was considered to be a potential concern based on a statistical comparison of on site to background soil concentrations. Mercury was considered to be a potential concern based on a comparison of on site concentrations to published U.S. Geological Survey background soil concentrations. No other inorganics were considered of potential concern. Lead and mercury concentrations are presented in Table 2 of the ROD.

6.3.2 Subsurface Soils

In the Study Area, twenty two organic and eighteen inorganic chemicals were detected in subsurface soil samples. Of the organic contaminants, 1,1,2-trichloroethane and pentachlorophenol were eliminated as potential chemicals of concern based on their low frequency of detection. The remaining organics were retained in the risk analysis. These contaminants and their concentrations are presented in Table 3 of the ROD.

Fourteen of the eighteen inorganics were detected in background samples. Although as noted in Section 5.2.2, inorganic contamination of subsurface soils did not appear to be significant considering the raw data, statistical data analysis indicated that arsenic, barium, chromium, cobalt, iron, lead, magnesium, manganese, nickel, potassium, vanadium and zinc exceeded background levels. Calcium exceeded published background values. These inorganics are considered in the risk analysis. A summary of the inorganic substances detected in the Study Area subsurface soils is presented in Table 4.

6.3.3 Surface Water

Table 8 lists the concentrations of the organic chemicals found in surface waters in the Study Area and Table 9 summarizes the concentrations of the inorganic substances found in the Study Area and compares those values to background levels.

In addition to samples collected in the Study Area, samples were collected downstream from the Study Area in locations where either the unpermitted drum disposal locations or the permitted landfill may be the source of contaminants found in the streams. No organic chemicals were detected in the samples collected in these downstream areas. Any inorganic contaminants found in the downstream areas may be derived from either the permitted landfill or the drum disposal locations.

For the Risk Assessment, chloroethane, 1,1-dichloroethene, methyl butyl ketone, chlorobenzene, phenol, benzyl alcohol, and di-n-octylphthalate were eliminated as potential chemicals of concern based upon a low frequency of detection. The other organics detected in surface water were retained for the risk assessment. Statistical analysis indicated that aluminum, iron, manganese, and potassium in the Study Area exceeded background levels. Calcium, magnesium and potassium in samples collected downstream from the Study Area exceeded background levels. Many inorganic substances found in surface water were compared to background ground water concentrations because they were not found in background surface water samples. From this comparison, antimony, barium, cadmium, chromium, cobalt, lead, mercury, silver, vanadium, zinc, and cyanide were retained as chemicals of potential concern.

6.3.4 Stream Sediments

Table 10 lists the organic substances found in stream sediments in the Study Area. Organic substances were also found in several sediment samples collected downstream from the Study Area. The source of chlorinated aliphatic compounds, ketones, and monocyclic aromatic compounds found in these downstream sediments may either be the unpermitted drum disposal areas or the permitted landfill. Polycyclic aromatic compounds found in the downstream samples are attributed to the permitted landfill in the Endangerment Assessment Report; however, some of these compounds are found in a few of the Study Area sediment samples. Phthalates and PCBs found in downstream sediment samples are attributed to the unpermitted disposal areas. A summary of the downstream sediment sample organic concentrations and a comparison of those concentrations to the Study Area concentrations is presented in Table 11.

Inorganic substances detected in Study Area sediments are summarized in Table 12. In addition to the inorganic substances found in the Study Area, several inorganic substances attributable to either contamination from the unpermitted drum disposal areas or the permitted landfill were found in sediment samples collected downstream from the Study Area. A summary of the inorganic substances found in samples collected downstream from the Study Area and a comparison of those concentrations to Study Area concentrations is presented in Table 13. Statistical analysis of the inorganic data for sediments indicated that chromium and zinc exceeded background levels in the Study Area sediments. Based on a comparison of inorganic concentrations in sediment to published background values, barium and lead exceeded background in the Study Area sediments and calcium, cobalt, iron, magnesium, nickel, and vanadium exceeded background in sediment samples collected downstream from the Study Area. Other inorganic substances were not considered in the risk assessment.

6.3.5 Ground Water

Tables 5 and 6 list the organic compounds detected in ground-water samples from Study Area monitoring wells. Several of these compounds have maximum contaminant levels (drinking water standards) that are ARARs; other organic compounds are of potential concern from a health effects perspective and are also included in the risk assessment. Carbon disulfide, 1,1 dichloroethene, chloroethane, toluene and bromochloroethane were not considered in the risk analysis.

The inorganic chemicals of potential concern that were detected in the ground-water samples from the Study Area monitoring wells are summarized in Table 7. Statistical analysis could not be used to evaluate differences between background and Study Area wells because of the small background sample size. Inorganics in Study Area samples were considered to be above background and of potential concern if they exceeded background by at least a factor of 2. Using this criterion, the inorganics of concern that were considered in the Risk Assessment include calcium, chromium, cobalt, iron, lead, manganese, nickel, potassium, and zinc. Of these inorganics, calcium, cobalt, iron and potassium do not have any toxicity criteria established by EPA and were therefore only qualitatively considered in the risk assessment.

6.4 Toxicity Assessment Information

As described in Section 6.2.3, the risk assessment considered the reference doses (RfDs) in assessing the health risks posed by non-carcinogens and the cancer potency factors (CPFs) when evaluating the risks posed by known or probable carcinogens. The oral and inhalation RfDs and CPFs are compiled in the Endangerment Assessment Report and are presented in Table 15.

Many of the CPFs are derived from animal studies, where animals are subjected to high doses of chemicals. Since humans are expected to

TABLE 15
SUMMARY OF HEALTH EFFECTS CRITERIA FOR CHEMICALS OF POTENTIAL CONCERN+

Chemical	Oral Criteria RfD mg/kg/d	Oral Criteria CPF $mg/kg/d^{-1}$	Inhalation Criteria RfD mg/kg/d	Inhalation Criteria CPF $mg/kg/d^{-1}$
Vinyl Chloride	--	2.3	--	2.9E-1
Acetone	1E-1	--	--	--
1,1-Dichloroethane	--	9.1E-2	--	--
1,2-Dichloroethene	2E-2	--	--	--
Methyl Ethyl Ketone	5E-2	--	9.6E-2	--
1,1,1 Tricloroethane	9E-2	--	3E-1	--
Trichloroethene	7.4E-3	1.1E-2	--	4.6E-3
Benzene	--	2.9E-2	--	2.9E-2
Methyl Isobutyl Ketone	5E-2	--	--	2E-2
Tetrachloroethene	1E-2	5.1E-2	--	3.3E-3
Toluene	3E-1	--	1	--
Ethyl Benzene	1E-1	--	--	--
Xylenes	2	--	--	--
Cresols++	5E-2	--	--	--
Isophorone	1.5E-1	--	--	--
Benzoic Acid	4	--	--	--
Noncarcinogenic PAHs*	4.1E-1	--	--	--
Carcinogenic PAHs*	--	1.2	--	6.1
Di-n-Butylphthalate	1E-1	--	--	--
Benzyl Butyl Phthalate	2E-1	--	--	--
Bis (2-Ethylhexyl) Phthalate	2E-2	--	--	--
PCBs	--	7.7	--	7.7
Arsenic	--	1.8	--	50
Barium	5.1E-2	--	1E-4	--
Chromium VI	4.8E-3	--	--	4.1E-1
Chromium III	1	--	--	--
Lead	1.4E-4	--	--	--
Manganese	2.2E-1	--	3E-4	--
Mercury	2E-3	--	--	--
Nickel	2E-2	--	8.4E-1	--
Vanadium	7E-3	--	--	--
Zinc	2.1E-1	--	--	--

notes

+ Excludes inorganics without quantitative health effects criteria (aluminum, calcium, cobalt, iron, magnesium, and potassium)

++ Cresols are the sum of 2-,3-,4-methyl phenol and 2,4-dimethyl phenol

* Noncarcinogenic PAHs are the sum of acenaphthene, benzo(g,h,i) perylene, fluoranthene, naphthalene, 2-methylnaphthalene, and pyrene. Carcinogenic PAHs are the sum of benzo(a) anthracene, benzo(a)pyrene, benzo (B/K)fluoranthene, and dibenzo(a,h)anthracene.

-- Indicates either not applicable or that no information was given in the Endangerment Assessment Report be exposed to lower doses than those used in animal studies, the data are adjusted using mathematical models to get CPFs. Adjustments are made to allow for a several-fold safety factor in determining the CPF, to account for the uncertainty inherent in the conversion of animal study data to human health risk estimation. Thus, the actual risks associated with exposure to a potential carcinogen are unlikely to exceed risks estimated by the CPF determined from animal data and in fact, the risks may be much lower. CPFs based on human epidemiological data are also derived using very conservative assumptions and are unlikely to underestimate risks.

The Endangerment Assessment Report presents detailed discussions of toxicological references concerning the chemicals of concern in the Study Area.

6.5 Risk Characterization

Excess lifetime cancer risks are determined by multiplying the intake level by the cancer potency factor. These risks are probabilities that are generally expressed in scientific notation (e.g., $1\text{x}10^{-6}$ or 1E-6). An excess lifetime cancer risk of $1\text{x}10^{-6}$ indicates that, as a plausible upper bound, an individual has a one in one million chance of developing cancer as a result of site-related exposure to a carcinogen over a 70-year lifetime under the specific exposure conditions at a site. EPA has implemented actions under Superfund associated with projected excess lifetime cancer risks ranging from $1\text{x}10^{-4}$ (one in 10,000) to $1\text{x}10^{-7}$ (one in 10,000,000). A risk level of $1\text{x}10^{-6}$ is often used as a benchmark risk level by EPA, and the risk assessment followed this approach.

Potential concern for noncarcinogenic effects of a single contaminant in a single medium is expressed as the hazard quotient (HQ), which is the ratio of the estimated intake derived from the contaminant concentration in a given medium to the contaminant's reference dose. By adding the HQs for all contaminants within a medium or across all media to which a given population may be reasonably exposed, the Hazard Index (HI) can be generated. The HI provides a reference point for determining the potential significance of multiple contaminant exposures.

6.5.1 Current-Use Scenario Risks

6.5.1.1 Risks to Trespassers from Surface Soils

Table 16 summarizes the risks associated with surface soils. Total excess lifetime cancer risks are estimated to be $3\text{x}10^{-8}$ and $5\text{x}10^{-4}$ for the average and plausible maximum exposure cases respectively. The risk is essentially due to PCBs. The average case is based on a geometric mean PCB concentration of 0.5 mg/kg, while the plausible maximum case assumes a PCB concentration of 208 mg/kg. The Hazard Index is less than 1 for the average case while in the plausible maximum case, it exceeds 1 because of exposure to lead.

6.5.1.2 Risks to Trespassers from Sediments

Table 16 summarizes the risks to trespassers from dermal contact with stream sediments. The excess lifetime cancer risks in the average exposure case and the plausible maximum exposure case are estimated to be $2\text{x}10^{-7}$ and $2\text{x}10^{-4}$ respectively. The risks are associated with carcinogenic PAHs and PCBs. The risk levels have incorporated into the calculations the presence of contaminated sediments downstream of the Study Area, some of which may be derived from the permitted landfill. Hazard indices are less than one for both the average and the plausible maximum exposure cases.

6.5.1.3 Risks to On-Site Trespassers from Contact with Surface Water

Table 16 summarizes the risks to on-site trespassers from dermal contact with surface water. The excess lifetime cancer risks in the average case and the plausible maximum cases are estimated to be $1\text{x}10^{-6}$ and $3\text{x}10^{-5}$ respectively. The risks are primarily associated with PCBs. Hazard indices are less than one for both exposure cases.

6.5.1.4 Risks to Off-Site Residents from Contact with Surface Water and Stream Sediments

Exposure is assumed to occur if children wade or play in or near Blue Lick Creek. Excess lifetime cancer risks due to carcinogenic PAHs are estimated to be $2\text{x}10^{-7}$ and $1\text{x}10^{-5}$ under the average and plausible maximum exposure cases respectively. Hazard indices are less than one for both exposure scenarios. Since PAHs are associated with the permitted landfill, some if not most of the risk from this exposure is attributed to the landfill rather than to the Study Area.

6.5.1.5 Risks from Inhalation of Dust Generated by Dirt Bikes

The excess lifetime cancer risks to dirt bike riders are estimated to be $1\text{x}10^{-12}$ and $4\text{x}10^{-11}$ under the average and the plausible maximum cases respectively. Hazard indices are less than one for both cases.

6.5.1.6 Risks to Trespassers from Inhalation of Volatile Organics Released from Surface Water

Table 16 summarizes the risks to site trespassers associated with the inhalation of organics released from surface water. Excess lifetime cancer risks are $2\text{x}10^{-3}$ and $6\text{x}10^{-2}$ under the average and plausible maximum cases respectively. The risk is attributable to

TABLE 16
TOTAL CARCINOGENIC AND NONCARCINOGENIC RISKS OF CONCERN FOR ALL EXPOSURE AND ENVIRONMENTAL MEDIA CONDITIONS-CURRENT-USE SCENARIO

Environmental Medium, Chemical, and Exposure Conditions	Concentration Avg. Case	Concentration Max. Case	Risk or Hazard Avg. Case	Risk or Hazard Max. Case
1. Surface Soils Contacted by Trespassers(mg/kg)				
PCBs	4.74E-1	2.08E+2	2.90E-8	4.54E-4
Total cancer risk			3E-8	5E-4
Lead	5.50E+1	8.90E+3	3.08E-2	1.99E+1
Hazard Index			3.08E-2	1.99E+1
2. Stream Sediments Contacted by Trespassers (mg/kg)				
Carcinogenic PAHs	2.08	8.51E+1	1.24E-7	2.24E-4
PCBs	7.24E-1	6.54	3.49E-8	8.07E-6
Total Cancer Risk			2E-7	2E-4
3. Surface Water Contacted by Trespassers (mg/L)				
PCBs	1.72E-2	3.35E-2	1.39E-6	2.98E-5
Total Cancer Risk			1E-6	3E-5
4. Volatalized Organics from Surface Water Contacted by Trespassers (mg/m^3)				
PCBs	1.90E-1	3.90E-1	1.83E-3	6.21E-2
Total Cancer Risk			2E-3	6E-2
Methy Ethyl Ketone	3.50	1.20E+2	3.20E-1	3.29E+1
Methyl Isobutyl Ketone	4.90	7.30E+3	2.15	9.60E+3
Hazard Index			2.47	9.63E+3

PCBs. Hazard indices are greater than one under both exposure cases due to methyl ethyl ketone and methyl isobutyl ketone.

6.5.1.7 Risks from the Use of Residential Wells

Several residents living near the Smith's Farm site use well water. The Endangerment Assessment Report describes the potential risks associated with the use of the water from the individual wells that were sampled. Substances of concern were essentially inorganics, rather than organics associated with the landfill or Study Area.

Based upon the data available from the well sampling, there is no evidence that any of the water samples have been impacted by contamination from the Smith's Farm site. All of the inorganics found in the wells may be naturally occurring, and there are several possible sources of contamination in cases where well water samples contain any organic compounds. Therefore, there is no reason to conclude that the landfill or Study Area pose any risks to current ground-water users near the Smith's Farm site.

6.5.2 Future-Use Scenario Risks

6.5.2.1 Risks from Direct Contact with Soils by On-Site Residents

This scenario assumes that a residence will be placed on site in an area suitable for such land use. It is also assumed that subsurface soils might be brought to the surface during construction activities on site.

Table 17 summarizes the risks associated with these exposures. Only data from soil samples collected in areas deemed potentially suitable for locating a residence were considered in calculating these numbers. Excess lifetime cancer risks due primarily to arsenic are $3x10^{-6}$ and $4x10^{-5}$ under the average and plausible maximum cases rspectively. The hazard index is less than one for the average case exposure, but exceeds one for the plausible maximum case exposure because of potential contact with lead.

6.5.2.2 Risks from Use of On-Site Ground Water

The risks from the use of on-site ground water by future residents are presented in Table 17. Only monitoring data from monitoring wells located in the area of potential residential development were considered in the risk analysis. Total excess lifetime cancer risks were $1x10^{-3}$ and $2x10^{-3}$ for the average and plausible maximum cases respectively. Vinyl chloride and 1,1-dichloroethane are the main contributors to this risk. Hazard indices exceed one due to chromium, manganese, nickel, and lead.

TABLE 17
TOTAL CARCINOGENIC AND NONCARCINOGENIC RISKS OF CONCERN FOR ALL EXPOSURE AND ENVIRONMENTAL MEDIA CONDITIONS-FUTURE-USE SCENARIO

Environmental Medium, Chemical, and Exposure Conditions	Concentration		Risk or Hazard	
	Avg. Case	Max Case	Avg. Case	Max Case
1. Soils Contacted by On-Site Residents(mg/kg)				
Arsenic	1.34E+1	3.00E+1	2.59E-6	3.19E-5
Total Cancer Risk			3E-6	4E-5
Lead	2.50E+1	9.30E+2	1.68E-1	6.25
Hazard Index			1.89E-1	6.43
2. Ground Water Contacted by On-Site Residents (mg/L)				
Vinyl Chloride	6.00E-3	1.00E-2	1.31E-3	2.18E-3
1,1-Dichloroethane	5.00E-3	2.70E-2	4.31E-5	2.33E-4
Trichloroethene	4.00E-3	1.80E-2	4.17E-6	1.88E-5
Benzene	2.00E-3	2.00E-3	5.49E-6	5.49E-6
Total Cancer Risk			1E-3	2E-3
Chromium	3.90E-2	2.60E-1	2.32E-1	1.55
Manganese	1.01	1.60E+1	1.32E-1	2.08
Nickel	1.65E-1	8.80E-1	2.36E-1	1.26
Lead	6.00E-3	1.80E-2	1.22	3.67
Hazard Index			1.93	9.18

6.5.2.3 Risks to Off-Site Residents

The risks posed to future off-site residents from soils and ground water were determined by considering data outside the Study Area. Therefore, while providing some information on the risks posed by the permitted landfill, these data are not relevant to the remediation of the Study Area.

6.5.2.4 Other Future-Use Risks

As mentioned in Section 6.2.1, exposure to contaminated air, surface water, and sediment was assumed to be the same for both the current-use and future-use scenarios.

6.5.3 Qualitative Risks

In addition to quantifying the risks associated with exposure to some of the chemicals found in environmental media at the Smith's Farm site, the Endangerment Assessment Report presents a qualitative analysis of the risks posed by several inorganic substances found in the Study Area in concentrations above background levels. Concentrations of iron in soils and ground water are expected to contribute to risks under the exposure pathways considered in the risk assessment, while aluminum, calcium, cobalt, magnesium, and potassium are not expected to contribute to risks.

6.5.4 Summary of Human Health Risks

Tables 16 and 17 present the total carcinogenic and noncarcinogenic (hazard index) risks determined by the quantitative risk analysis, for all exposure and environmental media conditions. Individuals may be exposed to more than one source of risk; for example, future-use exposure to chemicals for a person living on site may be from both contaminated ground water and soils. Combined exposures such as this have an associated risk that is assumed to be the sum of the individual risks. Tables 16 and 17 could thus be used to determine the risk to an individual with more than one exposure pathway.

6.6 Environmental Risks

In addition to risks posed to human health by the Study Area, the risks posed to terrestrial and aquatic life by the contamination in the Study Area were estimated. This assessment was primarily based upon information obtained from relevant literature. The assessment identified potential receptors (animals and plants that could be affected); identified the exposure routes and estimated the amount of exposure to receptors; and used toxicity data and the exposure information to estimate the risks to the receptors.

6.6.1 Receptors

Potential terrestrial receptors in the Study Area are the deciduous plants found on site and the fauna that live in the forested areas in and around the Study Area. There are few potential aquatic receptors within the Study Area because of the intermittent stream flow. Downstream aquatic receptors may be present in Blue Lick Creek, although the stream probably supports a very limited, if any, fish population.

6.6.2 Exposure Routes

Exposures of terrestrial plants to chemicals from the Study Area may occur through exposure to polluted air or to soil or water contamination. Air and water exposure was not addressed in the Endangerment Assessment Report, while the soil exposure route was considered by a comparison of geometric mean surface soil concentrations to concentrations of chemicals that may affect plant life.

Terrestrial animals may be directly exposed to chemicals through inhalation of contaminated air or ingestion of contaminated soil or surface water. Although quantitative assessment of exposure through these exposure routes could generally not be done due to limited available information, possible exposures of animals to chemicals from drinking water was roughly approximated by assuming daily consumptions based on species type and animal size. For the assessment, it was assumed that the surface water of the Smith's Farm site was exclusively used as a drinking-water source by small mammals and birds of the area. Indirect exposure of terrestrial animals to contaminants through consumption of contaminated prey was not considered in the assessment.

Aquatic life could be directly exposed to chemicals from contaminated surface water or stream sediments, and indirectly through consumption of contaminated prey. In the Endangerment Assessment report, only the direct exposure pathways were assessed.

6.6.3 Toxicity Assessment

Toxicity criteria for the protection of aquatic life have been developed by both EPA and the Commonwealth of Kentucky for a limited group of chemicals, and these criteria could be compared to concentrations of those substances detected in streams at the Smith's Farm site. In all other cases, toxicity values were derived from the available literature. The toxicity values selected for the assessment were the lowest exposure concentrations or doses reported to be toxic or the highest concentrations or doses associated with no adverse effect. When available, toxicity values were derived from studies using species similar to the receptors that may be found at the Smith's Farm site. For the risk assessment, toxicity chronic values that were not available in the literature were estimated to be equal to one-fifth the acute lethality values that were available in the literature.

Uncertainty factors were applied to the toxicity data. A safety factor of 10 was applied to a lowest observed effects level (LOEL) derived from a chronic toxicity study and a safety factor of 100 was applied to a LOEL derived from subchronic or subacute studies. An additional safety factor of 2 was applied for endangered species.

Information about toxicity to terrestrial plants was available for only phthalate esters, PCBs, PAHs, and zinc, although there are many more chemicals of possible concern that are present in surface soils. Information about toxicity to terrestrial wildlife was available for ingestion of water containing ethylbenzene, PCBs, arsenic, barium, chromium, copper, cyanide, iron, lead, and nickel.

A relatively large volume of material concerning toxicity of chemicals to aquatic organisms is available in the literature. Ambient water quality criteria developed by EPA are developed to protect 95% of all aquatic species, and these criteria cover many of the chemicals of concern in surface waters at the site. Other aquatic toxicity data were available for most of the chemicals found in surface waters at the site.

Stream sediments provide habitats for many important aquatic species and the possible impacts of sediment contamination on aquatic organisms was therefore evaluated. Criteria for the protection of aquatic life from contaminated sediments have not been established, but an-EPA recommended approach using a surface water-sediment partitioning method was followed to derive interim sediment quality criteria. The criteria were calculated by multiplying ambient water quality criteria by chemical-specific partitioning coefficients.

6.6.4 Risk Assessment Results

Based on a comparison of concentrations of chemicals of concern in the soil of the Study Area to available literature information, there may be some adverse effect to plants from the zinc and PCBs found at some surface soil locations in the Study Area.

Effects to terrestrial organisms in the Study Area are not generally expected from drinking surface water, although the concentrations of PCBs detected at some locations exceed the chronic criterion set by EPA to protect mink drinking from such waters and consuming fish.

Therefore, it is possible that the concentrations of PCBs found in surface waters of the Study Area have an adverse effect on mink or similar species.

Several chronic aquatic toxicity criteria are exceeded in surface water and assumed to be exceeded in stream sediments. Aquatic toxicity criteria and the associated geometric mean and maximum values found in samples from surface waters and sediments at the Smith's Farm site are given in Tables 18a and 18b. The importance of these values is somewhat diminished because the streams in the Study Area may become dry during times of low rainfall.

7.0 DESCRIPTION OF REMEDIAL ACTION ALTERNATIVES

The Feasibilty Study report presents the results of a detailed analysis conducted on five potential remedial action alternatives for Areas A and B at the Smith's Farm site. This section of the Record of Decision presents a summary of each of the five alternatives that are described in the FS report. The five alternatives were evaluated by EPA by considering the following nine criteria:

- Short-Term Effectiveness
- Long-Term Effectiveness and Permanence
- Reduction of Toxicity, Mobility, or Volume
- Implementability
- Cost
- Compliance with Applicable or Relevant and Appropriate Requirements (ARARS)
- Overall Protection of Human Health and the Environment
- State Acceptance
- Community Acceptance

The alternatives and criteria used to consider the alternatives are in accordance with the National Oil and Hazardous Substances Pollution Contingency Plan 40 CFR Part 300, Subpart F, Section 300.68 and the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) as amended by the Superfund Amendments and Reauthorization Act (SARA), PL 99-499.

7.1 The "No Action" Alternative

The "No Action" (limited action) alternative is included for comparison to the other four alternatives. The alternative includes the installation of a fence around the contaminated part of the Study Area, placement of warning signs, and a long-term site monitoring program. Future use of the site would also be restricted. In addition, as required by law, a risk assessment would be performed every five years. Construction time for this alternative would be approximately three months.

TABLE 18a
COMPARISON OF AQUATIC TOXICITY CRITERIA TO CONCENTRATIONS OF CHEMICALS FOUND IN STREAMS AT SMITH'S FARM

	Surface Water	Stream Concentrations (ug/L)	
Chemical	Criteria (ug/L)	G. mean	Maximum
PCBs	0.014(c)	0.5	15
Xylenes	3000(a)	9.3	5200
Cadmium	3.9(a), 1.1(c)	2.1	52
Chromium VI	16(a), 11(c)	5.2	95
Cyanide	5.2(c)	11	20
Iron	1000(c)	1800	330000
Manganese	1500(a)	85	7500
Mercury	0.012(c)	0.14	0.92
Zinc	120(a), 110(c)	27	930

notes

The table only includes the chemicals for which either the acute (a) or the chronic (c) water quality criteria are exceeded

TABLE 18b
COMPARISON OF ASSUMED SEDIMENT QUALITY CRITERIA TO CONCENTRATIONS OF CHEMICALS FOUND IN STREAMS AT SMITH'S FARM

	Sediment	Stream Sediment Conc. (mg/kg)	
Chemical	Criteria (mg/kg)	G. Mean	Maximum
Acetone	0.22	0.021	1.2
PCB 1254	0.20	0.17	2.3
Arsenic	1.0	9.4	56
Cadmium	0.007	1.5	6.3
Chromium	0.22	24	120
Iron	25	3.4E+4	1.1E+5
Lead	3	40	990
Zinc	4	118	380

notes

Values are for an assumed organic carbon concentration in sediment of 1%

The table only includes the chemicals for which the assumed sediment quality criteria are exceeded

Risks to workers or nearby receptors from implementation of this alternative would be minimal or would not increase during remedial action at the site. Long-term risks would be unchanged, other than changes that will occur from natural processes. No reduction in toxicity, mobility, or volume of contaminants would occur under this alternative. Protection of human health and the environment would be minimal.

The "No Action" alternative would be easy to implement. The present worth cost of this alternative is estimated at $1,103,000. This cost results largely from the long-term monitoring/site assessment that would be performed. Capital cost is estimated to be $320,000 and operation and maintenance costs are estimated to be $783,000.

Compliance with surface water and ground-water ARARs would not occur under this alternative, because no cleanup of the site to meet water-quality criteria would occur.

Because this alternative does not result in the remediation of the contamination from the Study Area, the alternative is unacceptable to the Commonwealth of Kentucky. Based upon a limited response, the alternative is also unacceptable to local citizens because of the remaining health hazards associated with leaving the uncontrolled site in its present condition.

7.2 RCRA Cap Alternative

The RCRA Cap alternative would involve the placement of a multi-media cap over the areas contaminated by waste. Necessary design considerations, as outlined in Covers for Uncontrolled Hazardous Waste Sites, EPA/2-85/002 will be adhered to in the development of the RCRA cap design. The cap will minimize infiltration and leachate formation.

This alternative would require the excavation of 26,000 cubic yards of contaminated material from Area B and emplacement of the excavated soil and debris into Area A. Slopes in Area B are too steep to construct a waste repository there. Intact drums from Area B would be hauled offsite and disposed of in accordance with all applicable requirements.

In Area A, the topography necessitates re-contouring of the slopes and construction of retaining walls in order to accomodate the RCRA cap alternative. Additionally, because of the continued presence of drums and contaminated earth material, a leachate collection system would be constructed in Area A. It is assumed that the leachate volume will be approximately 500 gallons per year. The leachate would be drained into storage tanks which would periodically be pumped and the liquid would be transported off site for treatment and disposal at a RCRA-approved facility.

During the construction of this alternative, site workers would be protected from fumes and dust that might be generated. Risks to persons offsite are considered low. The construction period for the RCRA cap alternative is estimated to be approximately two years. Design and preparation activities would require approximately one year.

The long-term effectiveness for this alternative is considered acceptable, provided that periodic inspections and required maintenance are performed. Catastrophic failure of the RCRA cap and containment system could pose a serious problem, but with the proper design, the probability of this occurring is considered to be remote. Overall protection of human health and the environment will be achieved because the RCRA cap and leachate collection system will isolate the waste materials. This alternative leaves untreated waste in place and thus does not comply with the intent of SARA with regard to the reduction of waste toxicity, mobility, or volume.

This alternative would comply with chemical-specific ARARs because soil containing contaminants above cleanup levels would be isolated and all associated exposure pathways would be broken. No location-specific ARARs would apply to this alternative. Action-specific ARARs would include RCRA standards for cap construction and requirements related to protection of on-site workers. Most RCRA requirements are not triggered because waste would be excavated for purposes of consolidation and would not be treated. The requirements for RCRA cap construction would be met. OSHA health and safety regulations would be followed by site workers during construction.

This alternative requires a relatively sophisticated engineering design to assure the effectiveness and safety of the cap and leachate collection system. The steep slopes would pose a difficult, but not insurmountable, impediment towards implementation of this remedial alternative.

The estimated present worth cost of this remedial alternative is $11,397,000. Construction costs for this alternative are estimated to be $10,067,000. Costs for operation and maintenance of the cap and leachate control system are estimated to be $1,330,000.

The Commonwealth of Kentucky believes that the construction of a cap in Area A would be very difficult from an engineering perspective and thus does not favor this remedial alternative. The local community has expressed some concern about leaving untreated wastes in place and therefore does not favor this alternative.

7.3 Incineration, Solidification/Fixation, and On-Site Disposal

This alternative involves the on-site treatment of wastes and contaminated soil. Organic contaminants would be thermally destroyed by incineration. Metals left in the incinerator residue would be immobilized by solidification/fixation.

This alternative would require the excavation of all contaminated soil and drums from the Study Area, an estimated volume of 178,000 cubic yards of material. Approximately 5,200 cubic yards of contaminated creek sediments would also be treated. Intact drums would be carefully excavated then transported to a staging area where their contents would be tested to avoid mixing incompatible wastes when they are incinerated. Waste materials would be stockpiled on site to keep the incinerator running when inclement weather or other factors prevent waste excavation.

Excavation and waste transport could potentially generate additional short-term contamination at the site. The risks to on-site workers and to environmental receptors would be controlled by dust-suppressant measures, erosion controls, and air pollution control equipment on the incinerator. Risks to the local residents would be minimal.

The long-term effectiveness of this alternative is considered to be excellent. All contaminated material would either be destroyed or would be immobilized, and a significant reduction in toxicity, mobility and volume of the wastes would be achieved. The technologies that would be used at the site are proven. Long-term management and monitoring activities would be small in comparison to most of the other alternatives presented.

This alternative would be difficult to implement. It would require a comprehensive monitoring program, and extensive site construction and preparation would be required. The time to complete the remedial work of this alternative would be approximately seven years.

The estimated present worth cost for this alternative is approximately $95,600,000. The construction cost for this alternative is estimated to be $95,173,000, and the operations and maintenance cost is estimated to be $419,000. The high cost for this alternative is, among other things, related to the rugged terrain of the site and the heterogeneity of the waste materials that would be incinerated.

This alternative complies with most ARARs. The solidified material that would remain may contain inorganics in excess of cleanup levels, but the material would be treated to immobilize the waste and inhibit leachate generation. The alternative would comply with all location-specific ARARs. Requirements for incinerator operation included in 40 CFR Part 264 and 40 CFR Part 761 would be met by this alternative through proper design and operation of the incinerator. Incinerator stack emissions would meet provisions of the Clean Air Act. The alternative would meet all Land Disposal Restrictions in 40 CFR Part 268 becuase this alternative would treat waste to levels achievable under the best demonstrated treatment (BDAT) technology. RCRA requirements for closure and land treatment would not be applicable because it is assumed that the solidified incinerator residue would be demonstrably nonhazardous.

The alternative is protective of human health and the environment, since all contaminants contained in the soil would be destroyed or immobilized. Contaminant concentrations in ground water, surface water, and stream sediments are expected to decrease rapidly once the contaminant source is removed.

The Commonwealth of Kentucky has expressed concern about this alternative because of the paucity of information concerning the specific wastes and volumes of different waste components present in the areas to be remediated. The overall cost of this remedial alternative presents a state funding problem. The local community has expressed concern about the efficiency of the incinerator and the safeguards to prevent air emissions of toxic materials. Some citizens have also expressed a concern that an on-site incinerator would be used to treat waste from other locations.

7.4 Capping of Area A, Incineration and Solidification/Fixation of Area B

This alternative provides elements of the RCRA cap and incineration alternatives discussed previously. Steep slopes in Area B preclude capping of this area. This alternative would result in the removal and destruction of contaminants from Area B and the capping of wastes in Area A.

Area B wastes would be excavated and incinerated prior to capping of Area A. Simultaneously, trenches would be excavated in Area A to obtain additional information concerning the nature and volume of wastes of Area A. Further characterization of Area A would guide subsequent remedial activity in that area. Regrading and waste consolidation in Area A would provide additional information on the type and locations of wastes in Area A. Conceivably, wastes from Area A could be handled differently if assumptions regarding the nature of wastes in the Study Area prove to be incorrect. The time required to treat Area B wastes would be approximately three years; the time required to complete remedial work at Area A will depend upon the combination of remedial technology that is most appropriate for this area.

Short term site conditions and remediation requirements would be similar to those listed in the incineration alternative above, but will occur in a shorter time period and at a reduced scale. The short term conditions of the RCRA cap alternative will also occur during the site remediation.

Long-term effectiveness is considered to be good for this alternative. For Area B, the long term and implementability conditions discussed under the incineration alternative will apply. For Area A, the long term and implementability conditions will essentially be those described under the RCRA cap alternative. A significant reduction of toxicity, mobility and volume of contaminants will occur in the Study Area.

The estimated present worth cost for this alternative is approximately $26,900,000. The cost for construction and implementation of this alternative is estimated to be $25,561,000, and the operations and maintenance costs are estimated to be $1,330,000. The cost for ths alternative is dependent upon the actual volume of waste material that will be incinerated. The Feasibilty Study report describes how the costs for this alternative will vary depending upon the actual volume of incinerated material.

The ARARs associated with this remedial alternative are a combination of those applicable to the incineration and RCRA cap alternatives. This alternative will comply with chemical-specific, location-specific, and action-specific ARARs. This alternative is in partial compliance with the intent of SARA. Cap construction over Area A is not in compliance because waste is being left in place untreated.

The Commonwealth of Kentucky has expressed concerns about this alternative because of the perceived engineering difficulties for implementing the alternative and has concerns about the incineration of material without more complete knowledge of its characteristics. The local community has expressed concerns about on-site incineration and about leaving untreated wastes on site.

7.5 Off-Site Incineration and Off-Site Disposal

This alternative would require the excavation of approximately 178,000 cubic yards of contaminated material from the Study Area and the removal of approximately 5200 cubic yards of contaminated sediments and the transport of that material to an acceptable location for incineration and disposal of residuals. Short-term conditions on site would require the use of extensive measures to protect the health and safety of workers and to protect the environment. There also would be an element of risk to nearby residents posed by the transport of wastes on public roads.

The long-term effectiveness of this remedy would be very good. Long-term site management would be minimal. Toxicity, mobility, and volume of wastes in the Study Area would be significantly reduced.

Similar to some of the other alternatives, this option will be difficult to implement during on site construction and excavation activities because of the steep slopes and other site conditions.

There may also be difficulties associated with locating an approved facility to incinerate the wastes and to accept residual materials for disposal. Waste would have to be treated to meet Land Disposal Restriction requirements before it is disposed. The time required to complete this alternative is estimated to be 2 years.

This alternative is the most expensive of the options considered. The estimated present worth cost for this option exceeds $437,000,000. Total capital cost is estimated to be $437,462,000, while operations and maintenance are projected to cost $233,000.

This alternative would be protective of human health and the environment, and would comply with all ARARs. Residuals would be disposed of in a RCRA subtitle C hazardous waste landfill that would meet the appropriate ARAR RCRA requirements. All soil containing contaminant concentrations above the selected clean-up level would be removed so that the RCRA ARAR concerning clean-closure requirements (40 CFR Part 264) would be met. Transportation of contaminated material would be in accordance with apprpriate regulations.

The Commonwealth of Kentucky does not favor with this alternative because of its extremely high cost. Several individuals in the local community have expressed a preference for this alternative because it removes the risks associated with the site without on-site incineration.

7.6 Comparison of the Alternatives

Table 19 summarizes the major factors that were weighed when selecting the preferred alternative from the five alternatives listed above. These factors are also discussed in the narratives describing each of the remedial actions that were considered for the Study Area.

The alternatives are listed in Table 19 as follows:

- Alternative 1- No Action: No Action
- Alternative 2- RCRA Cap: Cap
- Alternative 3- On Site Incineration, Solidification/Fixation and Disposal: On Site
- Alternative 4- Capping of Area A, On Site Incineration, Solidification/Fixation and Disposal for Area B: Cap/On Site
- Alternative 5- Off Site Incineration and Disposal: Off Site

TABLE 19
COMPARISON OF THE FIVE REMEDIAL ALTERNATIVES

		Alternative			
Criteria	No Action	Cap	On Site	Cap/On Site	Off Site
Effectiveness/ Environmental Protection	minimal	OK	OK	OK	OK
Compliance with ARARs	no	some	most	most	yes
Implementability	easy	hard	hard	hard	hard
Cost (million $)	1.1	11.4	95.6	26.9	437
Estimated Time to Complete (years)	<1	2	7	3+	2
Community Acceptance	least++	no++	no*	no++*	most
State Acceptance	no[1]	no[2]	no[2,3]	no[2]	no[3]

notes

+ time to completion is dependent upon the exact amount of material incinerated

++ unacceptable because untreated waste is left on site

* unacceptable because of concerns with incinerator operation

1 unacceptable because of limited environmental protection

2 unacceptable primarily because of technical issues

3 unacceptable because of cost considerations

7.6.1 Overall Protection of Human Health and the Environment

Alternatives 2 through 5 would be protective of human health and the environment. Either the waste will be isolated from the environment (Alternatives 2 and 4) and/or the waste will be treated to levels that are protective of human health and the environment (Alternatives 3,4, and 5). Alternative 1 does not provide adequate protection of human health and the environment because wastes will neither be treated nor isolated from the environment.

7.6.2 Compliance with ARARs

Alternative 5 would comply with ARARs but would involve the transport of wastes off site for treatment. Alternative 3 would comply with most ARARs. Inorganics in the incinerator residuals could exceed cleanup levels, but would be immobilized by solidification/fixation. Alternative 4 combines elements of Alternatives 2 and 3. Alternative 4 would not fully meet SARA's preference for treatment because some waste would be left untreated. Alternative 2 would comply with ARARs but would not meet SARA's preference for treatment because contamination would be left untreated. Alternative 1 would not comply with ARARs because ground water and surface water quality would continue to be degraded above relevant and appropriate Federal and State regulatory standards.

7.6.3 Long Term Effectiveness and Permanence

Alternative 3 would result in little long term maintenance and potentially will be more effective than alternatives 1, 2, or 4, becuase waste will be treated rather than contained. Alternative 5 would be as effective as Alternative 3 because waste will be treated; furthermore, the residuals will be removed from the site. Alternative 2 requires periodic maintenance of the RCRA cap, leachate collection system and other components of the remedy. As designed, this alternative would be effective over a long period, but has the potential for being less effective than an alterntative that treats the waste. Alternative 4 combines elements of alternatives 2 and 3 and the long-term effectiveness of this alternative will be at least as good as the long-term effectiveness of Alternative 2. Alternative 1 would not be effective because wastes would be left in place untreated and exposed to the environment.

7.6.4 Reduction of Toxicity, Mobility or Volume Through Treatment

Alternative 5 will result in complete reduction of toxicity, mobility and volume of wastes at the site, because all wastes will be removed and treated off site. Alternative 3 will be almost completely effective in reducing the toxicity and mobility of the wastes and will result in some volume reduction. Alternative 4 will result in some reduction of toxicity and mobility of the waste and will result in a minor reduction in volume. Alternatives 1 and 2 will result in no reduction of toxicity, mobility or volume through treatment.

7.6.5 Short-Term Effectiveness

Alternative 2 would probably have the shortest time period between implementation of the remedy and the completion of the remedial actions needed to protect human health and the environment. Alternative 5 would require approximately the same amount of time for remedy completion of Alternative 2, provided that a facility for treatment and disposal of the waste could handle the wastes expeditiously. Alternative 4 would probably require more time than Alternatives 2 or 5. Alternative 3 would require several more years to complete than Alternatives 2, 4, or 5. Alternative 1 would require the least of amount of time to complete but would not achieve protectiveness of human health and the environment.

7.6.6 Implementability

Alternative 1 would be the most readily implemented. Alternative 2 would probably be easier to implement than any of the remaining alternatives but would be much more difficult to implement than Alternative 1. Alternatives 3, 4, and 5 would be difficult to implement. It is difficult to predict which would most readily be implemented.

7.6.7 Cost

Alternative 1 is the least costly. Alternative 2 is considerably more costly than Alternative 1. Alternative 4 is more costly than Alternative 2. Alternative 3 is considerably more costly than Alternatives 1,2, or 4, but is much less costly than Alternative 5. Alternative 5 is very costly.

7.6.8 State Acceptance

Alternative 1 is least acceptable to the state because it does nothing to protect human health and the environment. Alternatives 3 and 5 are prohibitively expensive to the state; otherwise, these alternatives would probably the most favorable. Although Alternatives 2 and 4 are not favored by the state, these options would be most acceptable considering the protectiveness and cost factors.

7.6.9 Community Acceptance

Alternative 1 is the least favored alternative to the local community because it does not protect human health and the environment. Alternatives 2, 3, and 4 are probably equally acceptable to the community; concerns about leaving waste capped and in place are probably somewhat less than concerns about operation of an on-site incinerator, but individuals in the community have expressed concerns about both of these issues. Alternative 5 would be the most acceptable to the local community, based upon comments made at the public meeting to discuss the proposed plan.

8.0 THE SELECTED REMEDY

Based upon consideration of the requirements of CERCLA, the detailed analysis of the alternatives, and public comments, EPA has determined that Alternative 4: Capping of Area A, Incineration and Solidification/Fixation of Area B is the most appropriate remedy for the Smith's Farm site, Operable Unit 01, Brooks, Kentucky.

Approximately 26,200 cubic yards of contaminated soil, surface drums, buried drums, and fill material will be excavated from Area B. Approximately 5,200 cubic yards of contaminated on-site sediments will also be excavated from the intermittent valley streams within the Study Area of the Smith's Farm site. The contaminated sediments and material from Area B will be treated using a thermal destruction unit. Approximately 50% of the treated material will then be further treated by solidification/fixation. Solidified material and treated soils will then be returned for placement into Area B.

Wastes within Area A will be consolidated and capped with an engineered cap in accordance with Federal and State requirements. In addition to capping Area A, the alternative includes the incineration of an as yet undetermined but minor volume of material in Area A. Prior to capping, exploratory investigations will be performed in Area A to further define the volume and nature of contaminants within that area. Upon completion of the remedial design and/or the waste consolidation, regrading, and exploratory investigation of Area A, the exact volume and location of material in Area A that will be incinerated will be determined. Criteria that will be used to determine the material to be incinerated are the numbers and locations of intact drums or waste "hot spots" that are uncovered in Area A and cost considerations. The treatment of selected Area A wastes would be the same as the treatment of Area B wastes.

8.1 Remediation Goals

The purpose of this remedial action is to reduce present risks posed by direct contact with Study Area soils contaminated with PCBs and lead, sediments contaminated with PAHs and PCBs within the Study Area, and inhalation of organics and PCBs from surface water within the Study Area. The risks posed to potential future on-site residents from contaminated ground water will also be reduced.

This remedy will address soils and/or sediments contaminated with lead, PCBs, and carcinogenic PAHs in excess of 500ppm, 2ppm, and 5ppm, respectively. These action levels are based on the plausible maximum exposure scenario and under that scenario, correspond to an excess lifetime cancer risk of 10^{-5}, with the exception of the action level for lead, which is considered by EPA as an appropriate soil lead cleanup level based upon a 1985 Center for Disease Control recommendation. These action levels are presented in Table 20.

TABLE 20

ACTION LEVELS FOR SOILS AND SEDIMENTS FOR THE SMITH'S FARM SITE STUDY AREA -- OPERABLE UNIT 01

Contaminant	Media	Unit	Action Level	Risk Level
Lead	Soil	mg/kg	500	NA[+]
PAHs	Sediment	mg/kg	5	10^{-5}
PCBs	Soil	mg/kg	2	10^{-5}
PCBs	Sediment	mg/kg	2	10^{-5}

notes

+ NA: not applicable. The hazard index associated with this action level would be reduced to less than 1.

Health-based action levels were developed only for those contaminants and exposure pathways that, in the baseline risk assessment, had shown either a potential excess lifetime cancer risk greater than 1 x 10^{-6} or a CDI:RfD ratio greater than one. Since no Federal or State ARARs exist for soil or sediments, the action levels were determined through a site-specific analysis. This analysis involved direct use of the Remedial Investigation monitoring data from environmental media and development of pollutant transport models to predict the migration of contaminants. Action levels are not required for contaminants and exposure pathways with risks less than those stated above, since the concentrations present already meet the action levels. Because of the effects of the source area remediation components of Alternative 4, surface water and shallow ground water remediation is not considered necessary. Thus, action levels for these pathways have not been established in this Record of Decision. However, contaminated seep discharges and ponded areas near the drum disposal sites with contaminant concentrations exceeding health-based action levels will be eliminated by the remedial action.

EPA guidance recommends the development of action levels in the risk range of 1 x 10^{-4} to 1 x 10^{-7}. The action levels of 2ppm for PCBs, and 5ppm for PAHs represent, as stated previously, a 10^{-5} risk level and were selected based upon factors such as the proximity to residential areas, risk to site trespassers, lack of site access deterrents, use of the maximum plausible values to estimate chronic daily contaminant intake levels, and action levels selected at other NPL sites having similar contaminants and site conditions. The action level of 500ppm for lead represents, as stated previously, a risk level selected on the basis of lead's toxicity to humans.

The excavated soils and sediments will be treated on-site using a mobile thermal destruction unit that will remove organic contaminants to the specified action levels. Residuals from the thermal destruction unit will be further treated to immobilize the remaining inorganic contaminants. At the completion of the remedial action, health risks posed by direct contact with the treated soils and sediments would be no greater than 10^{-5}.

This remedy will also serve to contain contaminants within Area A, thereby eliminating or greatly reducing infiltration of rainfall into this area. Containment of contaminants within Area A would eliminate the pathway by which contamination is entering the surface water, as well as the direct contact exposure pathway which is the basis for the majority of the unacceptable risk levels at the site. Surficial ground water recharge would be eliminated or greatly reduced by placement of a cap over Area A since this area receives recharge through surface water infiltration. Leachate collection and treatment would serve to eliminate or greatly reduce the accumulation of leachate that may still be generated as a result of leaking, buried drums within Area A. The cap will be designed and constructed to minimize the amount of leachate generation, promote drainage, minimize erosion of the cover, and provide long-term minimization of migration of liquids through the underlying drums and soil.

8.2 Attainment of Applicable or Relevant and Appropriate Requirements of Environmental Laws

8.2.1 Soil, Sediment, and Source Materials ARARs

Alternative 4 is designed to meet all applicable, or relevant and appropriate requirements (ARARs) of Federal, and more stringent, State environmental laws. The Federal ARARs include the Resource Conservation and Recovery Act (RCRA) (42 USCA Section 6901 et seq and 40 CFR Parts 257, 260, 261, 262, 263, 264, 268, and 269), the Toxic Substances Control Act (40 CFR Part 761), the Clean Air Act (42 USCA Section 7401 et seq and 40 CFR Part 50 and 61), and the Occupational Safety and Health Administration Act (40 CFR 1910). Potential State ARARs include: 601 KAR 1:025 -- Transportation of Hazardous Materials and KRS 174.415 -- Hazardous Materials, Permits, Emergency Procedures, Enforcement; 401 KAR 34:240, 50:025, 51:010, 51:052, 53:010, 63:010, 63:020, 63:021, and 63:005 pertaining to air pollution control requirements; and 401 KAR 34:070, and 47:040 pertaining to deed notices on solid or hazardous waste sites.

A. Federal Resource Conservation and Recovery Act

RCRA regulations will be applicable to the waste removed from the Study Area for incineration treatment. All such material will be considered RCRA characteristic waste, unless proven otherwise, or unless the waste is regulated by another statute such as the Toxic Substances Control Act.

Upon consolidation of drum waste and contaminated soils, Area A will be capped. Because disposal of hazardous waste at the Smith's Farm site Study Area occurred prior to the effective date of the RCRA regulation, the RCRA closure regulations are not applicable. However, they are considered relevant and appropriate. The relevant and appropriate requirements of RCRA Subtitle C regulations will be met by the selected remedy.

RCRA closure and post-closure requirements for all hazardous waste management facilities are outlined in 40 CFR Subpart G. Section 264.310 of RCRA Subpart N specifies the performance-based requirements for a cover at final landfill closure. The cover system for Area A in Alternative 4 will be a cap as prescribed in RCRA guidance and will comply with RCRA regulations. The cap will minimize migration of liquid through the landfill, function with minimum maintenance, promote drainage, minimize erosion, minimize leachate generation, accomodate settling, and be less than or equal to the permeability of natural subsoils present.

RCRA Land Disposal Restrictions for the disposal of hazardous waste are included in 40 CFR Part 268. 40 CFR Part 268 Subpart D requires treatment by the best demonstrated available technology (BDAT) before land disposal of RCRA-similar wastes. The treatment of wastes excavated from the Study Area will meet this requirement.

After closure is completed, the substantive monitoring and maintenance post-closure requirements contained in Section 264.117 through 264.120 of Subpart G will be conducted. Area A will be capped according to the standards in Subpart G Section 264.111 - Closure Performance Standards. After the closure activities have concluded, a survey plat, as prescribed in Subpart G Section 264.116, indicating the location and dimensions of the disposal area will be submitted to the local zoning authority, or to the authority with jurisdiction over local land use, and the Regional Administrator (Director, Division of Waste Management, Kentucky Natural Resources and Environmental Protection Cabinet).

The drum wastes and contaminated soils removed from Area B, other areas within the Study Area, and Area A must be properly disposed of or decontaminated as required in Subpart G Section 264.114. If it is determined that a portion of the wastes must be incinerated off-site, these wastes will be staged and repackaged on-site, and transported off-site for incineration at a RCRA treatment facility operating in compliance with 40 CFR Sections 264.340 through 264.351. The excavated waste will also be handled as regulated by Part 262 -- Standards Applicable to Generators of Hazardous Waste and will be transported in accordance with Part 263-- Standards Applicable to Transporters of Hazardous Waste.

It is anticipated that the majority of the waste will be incinerated on-site and the on-site incinerator will be operated in compliance with the technical requirements of Subpart O Sections 264.340 through 264.351 and more stringent state requirements, as appropriate. Incineration residuals will be treated by solidification/ fixation and it is anticipated that these residuals will be rendered non hazardous. Residuals will be tested by the appropriate method listed in Part 261 before being disposed to assure that the waste is not EP toxic characteristic (as defined in Subpart C, Section 261.24) and will if appropriate be evalauted using the TCLP test procedure (Part 268 Appendix I) to assure that the waste is not otherwise hazardous. Demonstration of the waste being rendered non hazardous will be used so that the regulations applicable to hazardous waste landfills (Part 264, Subpart N) are not applicable for the disposal of the treatment residuals.

B. Federal Clean Air Act

The Clean Air Act (CAA) identifies and regulates pollutants that could be released during earth-moving activities associated with the excavation and on-site incineration of soils, sediments, and drum wastes of the Smith's Farm Study Area. The CAA Section 109 outlines the criteria pollutants for which National Ambient Air Quality Standards have been established. CAA Section 112 identifies pollutants for which there are no applicable Ambient Air Quality Standards, those substances regulated under the Federal National Emmission Standards for Hazardous Pollutants. The CAA is an ARAR and the regulations standards will be complied with during implementation of Alternative 4. More stringent state regulations concerning the release of toxic air emissions will also be met.

C. Toxic Substances Control Act (TSCA)

The incineration of wastes containing polychlorinated biphenyls in concentrations greater than 50 ppm must be in accordance with TSCA regulations (40 CFR Part 761), in addition to the applicable incineration regulations in 40 CFR Part 264. Incineration of any wastes containing PCBs in excess of 50 ppm would comply with the TSCA regulations.

D. Federal Occupational Safety and Health Administration Act (OSHA)

The selected remedial action contractor must develop and implement a health and safety program for its workers, if such a program does not already exist. All on-site workers must meet the minimum training and medical monitoring requirements outlined in 40 CFR 1910. OSHA will also be complied with when construction of subsequent operable units at the site (if the subsequent operable unit RI/FS determines the necessity of remedial action).

8.2.2 Ground Water/Surface Water ARARs

Alternative 4 is designed to meet all applicable, or relevant and appropriate requirements of Federal, and more stringent, State environmental laws. Three groups of Federal environmental standards and criteria are considered ARARs for the ground water at the Smith's Farm site Study Area: Safe Drinking Water Act Maximum Contaminant Levels (MCLs), RCRA Ground Water Protection Standards, and Clean Water Act Ambient Water Quality Criteria. These are ARARs for ground water protection beneath the capped area of Area A, as well as for the affected ground water of the surficial aquifer downgradient of the Study Area. The CWA regulation is likewise an ARAR for protection of surface water relative to the Study Area.

Potential State ARARs for the regulation of surface water at the site which are more stringent than Federal requirements are included in the Kentucky Administrative Regulations, Title 401, Chapter 5:031. Bluelick Creek, and its tributaries which receive drainage from the Smith's Farm Study Area, are not specifically listed in the regulations. Therefore, contaminant-specific surface water quality standards for use as a warmwater aquatic habitat and domestic water supply would apply to Bluelick Creek and its tributaries.

A. Federal Ground Water ARARs

Maximum Contaminant Levels established under the Safe Drinking Water Act are ARARs at this site. MCLs are the maximum contaminant concentrations allowed in a regulated public water supply. These levels apply at the point of distribution ("at the tap") to public water systems having at least 15 service connections or regularly serving at least 25 individuals. Levels are based on a chemical's toxicity, treatability (including cost considerations), and analytical limits of detection.

MCLs are relevant and appropriate at the Smith's Farm Study Area for ground water protection because the aquifers beneath the site have been, and currently are being, used as a source of drinking water, and MCLs are the enforceable drinking water standard for public water supplies. Since MCLs apply to water at the point of use, these levels are appropriate for establishing water quality in the drinking water aquifers at the site. Ground water tapped for drinking water generally has minimal or no treatment. These standards will be applied to the ground water itself to ensure safe levels below the MCLs for the shallow ground water downgradient of the site.

B. Federal Surface Water ARAR -- Ambient Water Quality Criteria (AWQC) established under the Clean Water Act (CWA)

The CWA is an ARAR at this site since ground water eventually discharges to the surface water (Bluelick Creek and its tributaries). The AWQC are established for protection of freshwater aquatic organisms. AWQC will be met at the point the ground water discharges to the closest surface water body. Monitoring shallow ground water, upgradient of the surface water body, will assure compliance with AWQC.

C. Potential State Surface Water ARAR -- Title 401, Chapter 5:031

Criteria listed for waters used as a warmwater aquatic habitat were more stringent than potential Federal ARARs for three contaminants. These contaminants and their maximum allowable concentrations in surface water are PCBs (0.0014 ug/l), mercury (0.2 ug/l), and zinc (47 ug/l).

D. Potential State Surface Water ARAR -- Title 401, Chapter 34:020

This potential state ARAR involves the construction of a waste facility in a flood-prone area or such that flooding hazards are increased. The remedial design for the selected remedy will consider flood-prone areas.

8.3 Cost-Effectiveness

The selected remedy is cost-effective because it has been determined to provide overall effectiveness proportional to its costs, the net present worth value being $ 26,891,000. The estimated costs of the selected remedy are less than an order of magnitude of (16.3 times less) the estimated costs associated with off-site treatment and disposal (Alternative 5) and within an order of magnitude of (3.6 times less) the estimated costs of complete on-site treatment and disposal (Alternative 3), and yet the selected remedy will provide for an equal degree of protection to public health and the environment, achieves a significant reduction of toxicity, mobility, or volume, and meets the statutory preference for on-site treatment of contaminants.

8.4 Utilization of Permanent Solutions and Alternative Treatment Technologies (or Resource Recovery Technologies) to the Maximum Extent Practicable

EPA has determined that the selected remedy provides the best balance of permanent solutions and treatment technologies that can be utilized in a cost-effective manner for Operable Unit 01 at the Smith's Farm site. The selected remedy provides the degree of flexibility necessary to refine (after completion of exploratory investigations into Area A) remedial activities for Area A due to the inherent uncertainties associated with waste volume and estimates and waste characteristics in uncontrolled drum disposal areas. EPA has determined that the selected remedy provides the best balance of tradeoffs in terms of long-term effectiveness and permanence, reduction in toxicity, mobility, or volume achieved through treatment, short-term effectiveness, implementability, cost, also considering the statutory preference for treatment as a principal element and considering State and community acceptance.

While the selected remedy does not offer as high a degree of long-term effectiveness and permanence as on-site incineration and solidification/fixation of all waste (Alternative 3), it will reduce the inherent hazards posed by the contaminated soils and sediments through thermal destruction of a significant amount of organics and immobilization of a significant amount of inorganics in Area B, thermal destruction of organics and immobilization of some inorganics in Area A, and containment of the remaining wastes within Area A such that the contained waste can be controlled and monitored. Thermal destruction of organics within Areas A and B and in the creek sediments of the valley streams will eliminate unacceptable levels of risk associated with those contaminants. Solidification/fixation of residual inorganics will physically and chemically lock contaminants within the soldified mass, thereby eliminating unacceptable levels of risk associated with those contaminants. Containment of wastes within Area A would serve to isolate contaminants and all associated exposure pathways would be broken.

Requirements for the thermal destruction unit are included in 40 CFR 264 and 40 CFR 761 and include disposal of residues, removal efficiencies for various waste types and monitoring of various parameters during operation. The incineration equipment to be installed at Smith's Farm would be designed and operated to comply with all of these requirements. Air pollution control equipment would be installled to conform to provisions of the Clean Air Act and, specifically, in accordance with 40 CFR Part 264.343, at least a 99.99 percent destruction and removal efficiency on stack emissions would be achieved, and will conform with 40 CFR Part 761.70, as appropriate.

Solidification/fixation of residuals from the thermal destruction of wastes would transform the hazardous constituents (inorganics) into relatively inert material with respect to the generation of leachate. This is accomplished by the mixing of the waste with pozzuolanic materials such as lime, fly ash and cement kiln dust. Significant changes in physical properties of the waste occur upon completion of the cementatious reaction, including an increase in physical strength and a decrease in permeability. Implementation of the solidification/fixation technology at other NPL sites has shown that, due to changes in the physical properties, leaching of hazardous constituents from the solidified material is significantly reduced, often to the point where the material can remain in place with no risk of hazardous leachate generation. Treatability tests would be performed on the waste during remedial design to determine the proper waste/additive ratio and to assure that the solidified mass meets leachability requirements. The treated waste will be tested as necessary to demonstrate that it is non hazardous.

While the containment of waste within Area A does not offer as high a degree of long-term effectiveness and permanence as incineration or off-site disposal of Area A wastes, it will serve to mitigate the risks associated with exposure to contaminants and significantly reduce infiltration of surface water. Contaminant migration would also be curtailed through the collection and off-site treatment of leachate from Area A. Periodic maintenance of the cap and leachate collection system would preserve the integrity and reliability of the containment system.

The selection of treatment of contaminated soils and sediments of Area B is consistent with program expectations that indicate that treatment of highly toxic and mobile waste is a priority and is often necessary to ensure the long-term effectiveness of a remedy. The major tradeoffs that provide the basis for this selection decision are cost, reduction of toxicity, mobility, and volume, and long-term effectiveness. The selected remedy combines treatment of a significant portion of the waste in a cost-effective manner, while at the same time including a degree of flexibility in determining the most appropriate remediation for Area A. Thus, Alternative 4 has been determined to be the most appropriate remedy for Operable Unit 01 at the Smith's Farm site.

8.5 Preference for Treatment as a Principal Element

By treating a significant portion of the contaminated soils and sediments at the Smith's Farm site through incineration and solidificaiton/fixation, the selected remedy addresses one of the principle threats posed by the site through the use of treatment technologies. Therefore, the statutory preference for remedies that employ treatment as a principal element is satisfied.

RESPONSIVENESS SUMMARY
SMITH'S FARM SITE- FIRST OPERABLE UNIT
BROOKS, KENTUCKY

This responsiveness summary is divided into the following sections:

Section 1. Overview: This section discusses EPA's recommended alternative for remedial action and public reaction to this alternative.

Section 2. Background on Community Involvement and Concerns: This section includes a brief history of community interest and concerns raised during remedial activities at the Smith's Farm site.

Section 3: Summary of Major Public Comments Received During the Public Comment Period and EPA Responses to the Comments: Both the comments and EPA responses to the comments are provided.

Section 4: Remaining Concerns: This section describes the remaining community concerns that were transmitted to EPA and that deal with activities conducted during the remedial design and remedial action project phases.

Section 1. Overview

EPA's preferred alternative for remedial action at the Smith's Farm site was presented to the public through the Proposed Plan (released on April 3, 1989) and at the public meeting on April 11, 1989. In the Record of Decision, EPA has selected a remedial alternative consisting of the placement of a "RCRA Cap" over part of the area of contamination (Area A) and the incineration and solidification/fixation of soils, sediments, and drum wastes within Area B. This alternative will involve the excavation and treatment of all contaminated soil and drums in Area B and the consolidation and capping of contaminated soil and drums in Area A. Treatment is provided for Area B because site conditions preclude capping there and in keeping with SARA's preference for treatment as well as a significant reduction in toxicity, mobility or volume of wastes. During remediation of Area B, additional data on the nature of contaminants present in the study area would be collected, both from that part of the site and through construction of several exploratory trenches in Area A. A small amount of selected wastes identified during exploratory work or waste consolidation conducted in Area A will be treated by incineration and solidification/fixation.

The community expressed no strong preference for any of the remedial alternatives that were considered. Most comments from the community concerned the use of an incinerator at the site.

Section 2. Background on Community Involvement and Concerns

Media interest in both the Smith's Farm site and EPA's involvement with the site has been fairly high, beginning with the immediate removal action completed in 1984. Newspaper articles have documented activities at the site throughout the Remedial Investigation and Feasibility Study.

In contrast to the media interest, local interest in the site has only been moderate. Some citizens living nearby have expressed concern about uncontrolled site access, the potential for surface and ground-water contamination from the site, and the nuisance caused by trucks hauling waste materials to the Smith's Farm permitted landfill. Many of the citizens near Smith's Farm have expressed concern about the health hazards associated with the site. At the public meeting in April 1989, the public's concern with health hazards focused as much on the planned incineration of wastes as on the threat from the uncontrolled site itself. Although a number of comments and concerns were raised in the public meeting concerning the proposed plan, only one follow-up letter was received from a local citizen during the public comment period. Overall, however, there has not been a great degree of public interest in this site relative to many Superfund sites. Outside of the local area, and aside from the media interest, interest in the Smith's Farm site seems to be minimal.

Section 3. Summary of Major Public Comments Received During the Public Comment Period and the EPA Responses to the Comments

The comments include both those expressed at the public meeting on the proposed plan on April 11, 1989, and the written comments received during the public comment period from April 11 through May 2.

A number of comments were received from citizens during the public meeting held on April 11:

1. One citizen expressed a concern that the twenty-one day period allotted for public comment on the proposed plan was inadequate.

EPA Response: The twenty-one day period is the time period required by the National Contigency Plan (40 CFR Part 300, Section 300.67(d)).

2. Several citizens expressed concern that there is presently uncontrolled public access to the Smith's Farm site. One citizen also was concerned about site access during, and following, the remedial action.

EPA Response: The access road leading into the property is blocked by a locked gate so that unauthorized vehicular traffic cannot enter. Warning signs have been placed around the site to notify persons that it is a hazardous area and that entry should be avoided. Access will be tightly controlled during the remedial action to assure that unauthorized persons do not enter the site. Waste burial areas will be posted and fenced off once remedial actions are completed.

3. Several citizens expressed concern that an incinerator brought to the Smith's Farm site would be used to treat wastes brought in from other locations.

EPA Response: The Record of Decision specifies that the on-site incinerator is for the treatment of wastes from Smith's Farm alone. There are legal requirements concerning the transportation, storage, treatment and disposal of hazardous wastes that would deter treatment of wastes from off site locations. Additionally, it would not be cost-effective to transport materials from another nearby Superfund site and then to transport the residuals off site.

4. Several citizens questioned EPA about transporting wastes from Smith's Farm to either an operating or a proposed commercial incinerator near the site for off-site treatment.

EPA Response: It would not be cost-effective to transport a large volume of contaminated material from the site to a nearby off site incinerator and then transport treatment residuals back to the site for disposal. There would be risks to the community involved with transporting the waste on public roads. It is uncertain, but very doubtful, that the off-site incinerators would or could (1) accept waste materials from Smith's Farm; (2) treat the wastes to acceptable standards considering both incinerator air emissions and requirements for thermal destruction of organics; and (3) handle the wastes in an acceptable time period.

4. Several citizens were concerned that the mobile incinerator would not be operated correctly or could malfunction, releasing hazardous materials into the air.

EPA Response: The incinerator will be thoroughly tested in trial burns before being operated. It will be required to meet very stringent air emission control standards mandated by the Clean Air Act requirements, including restrictions on organic emissions and emission of low boiling-point metals. During its operation, the incinerator will be monitored to assure that it is operating properly. Such incinerators have a proven record of success in hazardous waste cleanup at other sites.

5. One citizen expressed a concern about the integrity and design of the RCRA Cap that would be placed over some of the waste.

EPA Response: The cap will be designed to withstand any earth movements that might reasonably be expected in the area. The cap will be periodically monitored and repaired if necessary. Leachate draining from the fill beneath the cap will be collected and treated.

6. Several citizens believe that EPA should initiate some type of health study of residents near the Smith's Farm site.

EPA Response: The threats posed to persons on the site have been evaluated by the Agency for Toxic Substances and Disease Registry through a Preliminary Health Assessment. A substantial amount of data have been collected by EPA which indicate that there presently is very little, if any, threat to persons living near the site who do not enter the site itself. These data include stream water and sediment samples and samples collected from private wells. If contaminants are left on site above health-based levels, risk assessment updates are required for the site once every five years, to re-evaluate the risks posed by the site.

7. Several citizens asked about how much weight EPA gave to community concerns regarding the proposed plan.

EPA Response: The weight EPA gives to community concerns varies from site to site. Where a community is overwhelmingly and vociferously opposed to EPA's proposed remedial alternative and the alternative preferred by the community is as protective of human health and the environment at a comparable cost and probable reliability, the community's preference would probably be favored. In other cases, a proposed alternative would be somewhat modified by EPA after consideration of a community's concerns. In many cases, there are other, more compelling considerations that EPA must take into account. Such considerations would, for example, involve the requirements of law (CERCLA, SARA, the Clean Water Act, etc.) or the adherence to sound science and engineering practices.

8. One citizen had a concern about drinking water contamination. He commented that EPA could pay for extension of a city water line to supply citizens near the landfill with water at a cost far below the projected cost for the preferred remedial action alternative.

EPA Response: Testing of water supply wells and streams in the area of the site has not indicated that EPA should provide water to nearby residents. If further testing reveals that there is a health risk to persons living near the landfill from their water supplies, EPA would act to assure that these persons had a safe, reliable source of drinking water.

9. Several citizens asked why EPA couldn't implement the most expensive (and to them, the most acceptable) remedial action Alternative 5, since EPA had the opportunity to recover the expenditures from the PRPs.

EPA Response: While it is true that EPA will seek to recover costs associated with conducting the RI/FS, Remedial Design, Remedial Action, and Operation & Maintenance, there is currently no agreement with the PRPs for reimbursement of costs and it is unknown how long the cost-recovery process might take. The remedial action proposed by EPA will be protective of human health and the environment. EPA cannot justify choosing a much more costly remedial action over one that is, overall, as protective of human health and the environment.

10. In addition to the comments made at the April 11 public meeting, one citizen submitted a written comment expressing a preference for Remedial Alternative 5.

EPA Response: EPA has selected an alternative that is as protective of human health and the environment as Alternative 5. Based upon the primary criteria of protectiveness and compliance with laws, Alternative 4 is as environmentally effective and is more cost effective than Alternative 5.

Comments on the proposed plan were also received from one corporation marketing a pollution control technology, a consortium of Potentially Responsible Parties, and the Kentucky Resources Council.

11. The company marketing the pollution control technology advocated the use of an in-situ vitrification technology to treat and immobilize waste in place of the proposed alternative.

EPA Response: In-situ vitrification was considered in the Feasibility Study but was dropped as a viable approach to remediation at the Smith's Farm site. This technology, while offering great promise in the remediation of certain sites, may be inappropriate where areas of buried drums are located. The in-situ vitrification technology does not have the record of success demonstrated by other thermal destruction methods (incineration). Additionally, in-situ vitrification would be difficult to implement properly because of the steep terrain at the Smith's Farm site and would be resource and cost intensive.

12. The Kentucky Resources Council expressed the opinion that the site had not been characterized enough to support the selection of a remedial alternative for the unpermitted disposal areas at the Smith's Farm site.

EPA Response: EPA believes that the unpermitted drum disposal areas have been characterized adequately to support the selection of the proposed remedial alternative. While the exact nature of the contaminants buried in the unpermitted disposal areas is unknown, the following has been adequately established: (1) the waste materials are heterogeneous, which limits the remedial alternatives that can be selected; (2) the steep terrain in the disposal areas limits certain remediation options from consideration; (3) the approximate total volume of wastes, including contaminated soil, is known; (4) the proposed alternative provides for further site characterization during remedial action; (5) the proposed alternative will substantially reduce, if not eliminate, shallow ground-water contamination in areas other than immediately beneath the capped waste in Area A and the proposed alternative does not preclude further ground-water remediation near the unpermitted disposal areas, if found to be needed during the second operable unit RI/FS; (6) any further characterization of waste materials in Area A or Area B will involve intrusive measures which are also planned for the remedial action, thus delay in remediation and witholding the selection of remedy would probably not be balanced by the benefit of additional characterization; (8) the success of the selected remedial action is not contingent upon the additional investigation suggested by the Kentucky Resources Council.

The total cost, and time period required to complete the remedial action could be somewhat better defined by additional investigation, but the benefit, if any, could be offset by the delays in remedial action implementation and the additional expenditures involved.

13. The Kentucky Resources Council is also concerned that the proposed plan does not address the risk posed by contaminated stream sediments.

EPA Response: EPA concurs that there is a need for reducing the level of risk posed by contaminated sediments in the valley streams within the study area and intends to include such stream sediments with the wastes to be treated in the remedial action.

14. The Kentucky Resources Council is also concerned about EPA's plans or proposals to limit site access.

EPA Response: Currently, trespassers may enter the site on foot. The site has been posted to warn persons of the dangers on the site but there are no other deterrents to access. Access will be curtailed during and after site remediation begins. Persons who are intent on gaining access to the site will probably do so despite whatever deterrent is in place. The risks to both trespassers and the environment will be most greatly reduced by the planned remedial action.

15. The Kentucky Resources Council believes that the unpermitted disposal areas should be tied in to the permitted disposal area for remedial actions since the separation of these areas is an artificial distinction not truly related to site conditions.

EPA Response: EPA believes that while both the unpermitted drum disposal area and the permitted landfill are a part of the NPL site, there are some very real differences between the unpermitted and permitted areas. The unpermitted drum disposal area is located in a topographically different setting than the permitted landfill area. Stream water and sediment samples collected to date suggest that there are some differences in the contaminants leaching from the two areas. Co-remediation of Area A with the permitted landfill would almost certainly involve the transport, treatment, and burial of Area A wastes in the location of the permitted landfill. In order to meet legal restrictions for such an action, the waste would probably have to be treated at a cost well in excess of the proposed Alternative 4, without any offsetting increase in the protection of human health and the environment.

16. The Kentucky Resources Council suggested that careful testing and controls to prevent air pollution be implemented if on-site incineration is part of the remedial action.

EPA Response: EPA agrees.

The consortium of Potentially Responsible Parties (the PRPs) submitted a large volume of material concerning the Proposed Plan, the Remedial Investigation (RI), the Endangerment Assessment (EA), and the Feasibility Study (FS).

17. The PRPs suggested that the use of the maximum contaminant concentrations detected in soil, water, and sediment at the Smith's Farm site is inappropriate for use in calculating environmental risks. They also objected to the use of summed values of PCBs and PAHs from different locations for the maximum plausible case exposures.

EPA Response: The use of maximum levels is consistent with EPA guidelines on exposure assessments (Federal Register 51 34042-34054, September 24, 1986; Federal Register 53 48830-48853, December 2, 1988). The guidance states that an exposure assessment may include a sensitivity analysis or multiple scenarios; that is, the range of possible exposures may be considered, from the minimum to the maximum possible values. Although the use of maximum values would tend to overestimate risk, it is important to state the upper bound of the risk associated with the site. The worst-case values were not used alone to determine whether or not a problem exists at the Smith's Farm site. The use of the summed PCB and PAH values results in a more conservative estimate than would be the case if individual sampling points were used. However, the difference is less than one order of magnitude and has little impact on the results of the EA.

18. The PRPs believe that estimated concentration values (denoted by either a "J", which indicates an estimated value, or "N", which indicates a presumptive evidence of the presence of material), are not reliable. They therefore infer that any conclusions or interpretations based upon such data are erroneous.

EPA Response: The PRPs interpretation of "J" and "N" data is inconsistent with both EPA guidance and American Chemical Society guidance (1983) for the evaluation of environmental data. "J" and "N" values suggest uncertainty in the concentration level, but are valid analytical results. These values have therefore been used, with the qualification that they are estimates, in the EA.

19. The PRPs have objected to the use of one-half the detection limit in calculating geometric mean concentrations.

EPA Response: Non-detect data present some problem for whatever method is used to assign a value to them for geometric mean calculations. It is true that in some cases, a value of one half the detection limit would overestimate the true average concentration at a sample location; it could also underestimate the true average at that location. Geometric means were calculated only for those chemicals that were detected in RI samples and are therefore known to be present at the site. For background samples, where chemicals were not detected, no geometric means were calculated. Use of one-half the detection limit therefore in no way implies that non-detect background levels would be considered a problem in the endangerment assessment.

20. The PRPs believe that inappropriate health criteria have been used in the EA.

EPA Response: EPA disagrees with this conclusion. A value of 4.6E-03 $(mg/kg/d)^{-1}$ was used for the inhalation cancer potency factor for trichloroethene. This value is based on the 1984 Health Effects Assessment cited in the EA. The Health Effects Assessment lists a potency factor for an absorbed, metabolized dose of 1.3E-02 $(mg/kg/d)^{-1}$. In order to use this value for risk assessment, it must be converted to an ambient-dose value, which was done for the EA. The PRPs have misinterpreted the data obtained from the Health Advisory Document Addendum. The value of 1.7E-06 cited in that document is a unit risk (units of ug/m^3), not a cancer potency (units of $mg/kg/d^{-1}$). A unit risk is the excess lifetime cancer risk associated with exposure to 1 ug/m^3 of a chemical. Conversion of the unit risk to the potency factor gives a value comparable to that used in the EA.

Although proposed standards are generally not listed in an EA, an exception in this EA was made for lead. This decision was made because the chemical is being reclassified from a threshold to a non-threshold chemical. Given the high toxicity of lead and this reclassification, EPA believes that the use of the current Maximum Contaminant Level (threshold) or threshold goal would underestimate the potential risk from lead.

21. The PRPs also objected to the incorporation of data from the permitted landfill into the EA because it was outside the scope of investigation for the RI/FS. However, the PRPs believe that the data indicate that all off-site exposures and risks are attributable to the landfill and not the unpermitted drum disposal area.

EPA Response: Data from the permitted landfill allowed for some separation of the landfill effects on surface water and sediment concentrations from the unpermitted drum disposal area effects. While some chemicals migrating off site were related to the permitted landfill, others are, or may be, related to the unpermitted disposal areas.

22. The PRPs believe that EPA failed to properly consider background concentrations.

EPA Response: In cases where site-specific background data are available, these data are preferred over data obtained from published reports. The EA used site-specific background data where available.

Although on-site levels of arsenic do not exceed background levels, off-site levels were statistically above background. In addition to the health-based cleanup level for arsenic of 5 mg/kg for off-site exposure, the FS also listed the background level of 11 mg/kg as cleanup guidance.

7. The PRPs believe that the surface water volatization model used in the EA overestimates exposure due to overestimation of the area of release, miscalculation of the flux rate, and overestimation of the breathing rate.

EPA Repsonse: EPA believes that the model is appropriate. The area for release from surface water was taken as the area from which surface water samples had been collected on site. This is the total area available for release of contaminants. The assertion that both the flux rate and the emission rate were multiplied by the area is incorrect. The flux rate is multiplied by the area then divided by the volume of the air dispersion box to obtain the air concentration.

The breathing rate used in assessing exposure was 2.8 m^3/hr which is given by Anderson et al. (1985) as the breathing rate for adults engaged in moderate activity. This cannot be converted to 67.2 m^3/day, since breathing rates will be less during sleeping and other parts of the day.

24. The PRPs have suggested that a future-use scenario involving a resident on site is unrealistic.

EPA Response: Although such a scenario may be unlikely, it cannot be precluded as a possibility. Ground water is used by several area residents, indicating that the use of a well by an on-site resident is also a possibility. The future use scenario is consistent with the evaluation of a truly no-action alternative where no restrictions on site usage occur. EPA considers such a scenario for comparing a no-action alternative to site remediation and/or institutional controls.

25. The PRPs have produced their own endangerment assessment, using certain data collected in the Remedial Investigation; this assessment presents different conclusions than the EA prepared as a part of the Smith's Farm RI/FS.

EPA Response: The alternative assessment produced by the PRPs has relied on arbitrary rejection of valid data, use of less than conservative exposure assumptions, misinterpretation of toxicity data, and selective reading of EPA guidance documents to make its conclusions. EPA believes that while assumptions and value judgements based on limited data are a part of any risk assessment, the PRPs EA document is not a truly valid representation of risks associated with the Smith's Farm site.

26. The PRPs submitted several comments that refer to the selection of remedial action at the site. As an introduction to this topic, the PRPs state that EPA's selection of a preferred remedy for the Smith's Farm site is premature, inconsistent with the statutory and regulatory requirements of the Superfund Amendments and Reauthorization Act (SARA) and the National Contingency Plan (NCP), and is arbitrary and capricious. The PRPs further state that EPA has misconstrued and misapplied the balancing of factors required by Section 121 of SARA and by the NCP. The PRPs have concluded that EPA does not have sufficient information to select a remedy for the unpermitted drum disposal areas and have expressed a preference for Alternative 2, as identified in the Feasibility Study, over the selected remedial action, Alternative 4.

EPA Response: EPA responds to the introductory remarks summarized above by stating that the proposed plan is consistent with all statutory and regulatory requirements of SARA and the NCP; will meet all Applicable or Relevant and Appropriate Requirements as required by the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA) as amended by SARA, CERCLA Section 121(d); was selected after balancing the factors required by CERCLA Section 121; and is protective of human health and the environment. EPA believes that the remedial action was selected using sufficient and reliable data as presented in the RI and EA reports. Much of the PRPs disagreement with the Proposed Plan hinges on their assertion that there is insufficient data presented in the RI report and that the EA report presents a flawed assessment of the site risks.

27. The PRPs argue that cost as a selection factor was not properly considered in the selection of remedy.

EPA Response: In the Feasibility Study, five remedial alternatives that could be applied to the unpermitted drum disposal site were subjected to a detailed analysis. The alternatives have an estimated cost ranging from approximately one million dollars to an alternative that is projected to cost over four hundred million dollars. The least costly "no action" alternative would not be protective of human health and the environment and thus was not a reasonable alternative to select. Alternative 5, the most costly remedy requiring off-site waste incineration and disposal, would have provided no additional environmental protection to the area compared to the three remaining alternatives, provided that the other alternatives are designed, implemented, and maintained as specified in the FS. Furthermore, off-site dispsoal is not to be favored where practicable treatment technologies are available (CERCLA Section 121 (b)(1). Of the three remaining alternatives, Alternative 3, which provides for the treatment of all wastes from Area A and Area B, most closely complies with CERCLA Section 121 (b)(1) concerning the permanent and significant reduction of the volume, toxicity or mobility of contaminants; the long-term uncertainties associated with land disposal; and the preference for utilizing treatment technology as a part of the remedial action. Alternative 2 more closely complies with the cost-effectiveness provisions of CERCLA Section 121 than the other alternatives but does not provide for any treatment and does nothing to reduce the toxicity or volume of contaminants. Alternative 4 does provide for some treatment, and will result in a reduction in the volume, mobility, and toxicity of contaminants at a cost less than one third the cost of Alternative 3. EPA selected Alternative 4 over Alternatives 2 or 3 because it strikes a balance between the several important considerations listed in CERCLA Section 121 (b).

28. The PRPs believe that the selection of remedy was made using inadequate information to properly characterize the nature and extent of the waste and its effects on human health and the environment. They disagree with the use of a "worst-case scenario" in the risk assessment, the use of estimated concentrations in environmental data evaluation, the use of certain health criteria in the risk assessment, the use of site-specific background data in preference to published data representing background concentrations, and the method of analysis to define the surface water exposure route.

EPA Response: EPA has determined the following concerning the unpermitted drum disposal areas at the Smith's Farm site:

(1) The areal extent and approximate volume of contaminated materials (including soil) in the unpermitted drum disposal areas.

(2) The concentrations and distributions of organic and inorganic contaminants of concern in the soil, shallow ground water, and surface water and stream sediments in the unpermitted drum disposal study area and extending off site.

(3) The risks associated with the contamination from the unpermitted disposal areas, both for an "average case" and "plausible maximum case" (worst case) scenario.

EPA believes that inclusion of a "worst-case scenario" for risks is justified. This conclusion is based upon both the need to consider such and the inherent uncertainties in estimating risks at any site because of the limitations on sample size, seasonal variability of data, and so forth.

As stated previously, the use of estimated concentrations in environmental data analysis is justified, provided that the data is treated properly. Published data on background concentrations of naturally occurring substances in soil or other environmental media are generally used in environmental analysis only when no site-specific data are available. For the Smith's Farm RI, available site-specific data were used in preference to published data.

The methods, assumptions, references and data used in the environmental risk assessment (Endangerment Assessment Report) are completely documented in the report. Contrary to the conclusion of the PRPs, EPA believes that the risks portrayed in the report are plausible. The EPA has portrayed the risks from the Smith's Farm site as no more or less than what the RI and EA reports have indicated might be associated with the site.

Concerning the issue of the adequacy of site characterizations sufficient to justify the selection of remedial action, the PRPs have cited various parts of the the FS to support their contention that inadequate data were collected. These citations are in part either a selective presentation of what appears in the FS report, or are taken out of context. In several instances, the Remedial Investigation relied on non-intrusive, inferential methods to evaluate waste disposal area conditions rather than using much more costly and hazardous direct sampling techniques. EPA believes that combined with the environmental sample data that were collected for the RI, as well as previously collected data that were considered, these inferential data were both adequate for estimating the nature and extent of contaminated areas for the purpose of selecting a remedial alternative and were preferable to intrusive sampling on the basis of cost and risk compared to benefit.

As EPA has acknowledged, there is some uncertainty as to the exact nature and extent of material in Area A. EPA therefore has a flexibility in the Record of Decision so that EPA can evaluate the exact amount of Area A material to be incinerated. This flexibility would allow for the incineration of some additional material in addition to the small amount expected to be incinerated if it could be done in a cost-effective fashion. Because the remedial action will involve the movement of contaminated materials in Area A in any of the options under consideration (capping or incineration), it is reasonable to conduct a minimal amount of intrusive investigation at that time to more fully characterize Area A. EPA has selected a remedial action that has a possibility of achieving slightly more reduction of contaminant toxicity, volume and mobility than what is anticipated to occur if the incineration and solidification/fixation of additional materials in Area A should be determined to be cost effective.

A comment by the same PRPs regarding the draft workplan for the Remedial Investigation was that the proposed sampling plan included too many samples. Their present assertion that more data should be collected before the remedial action is selected is inconsistent with this earlier opinion.

29. The PRPs believe that remedial action of the permitted landfill should be combined with remedial action dealing with the unpermitted drum disposal areas.

EPA Response: This issue was previously addressed in the EPA response to a comment by the Kentucky Resources Council. It is important to reaffirm that delaying remediation of the unpermitted disposal area and then combining remediation of that area with the remediation of the permitted landfill would both delay addressing the threat to human health and the environment posed by the unpermitted drum disposal area and would result in a greater cost of remediation for unpermitted drum disposal area because of the need to excavate, treat and transport the entire volume of the waste. EPA cannot justify this option if it is no more protective of human health and the environment than Alternative 4 and will cost almost $100 million to implement.

Section 4. Remaining Concerns

The major concerns expressed concerning the remedial design and remedial action have been addressed in Section 3 of the Responsiveness Summary. One citizen expressed an interest in the EPA Technical Assistance Grant program at the public meeting. This individual was given some information about the program and was told to contact the EPA Community Relations Coordinator for additional information.